Agriculture and Agri-Food Canada
Research Branch

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Direction générale de la recherche

The Canadian Phytopathological Society
Société Canadienne de Phytopathologie

Canadian Plant Disease Survey

Inventaire des maladies des plantes au Canada

Volume 81, 2001
CPDS 81: 1 - 172
March, 2001

Volume 81, 2001
CPDS 81: 1 - 172
le mars, 2001

Canada

Agriculture and Agri-Food Canada Agriculture et Agroalimentaire Canada

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2001

THE CANADIAN PHYTOPATHOLOGICAL SOCIETY /

CANADIAN PLANT DISEASE SURVEY

- DISEASE HIGHLIGHTS

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The Society recognizes the continuing need for publication of plant disease surveys which benefit both federal and provincial agencies in planning appropriate research for the control of plant diseases. The reports you contribute are important to document plant pathology in Canada.

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Agriculture and Agri-Food Canada

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Agriculture et Agroalimentaire Canada

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(+ earlier years for historical significance)

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Authors who have traditionally published scientific notes in the *Canadian Plant Disease Survey* are encouraged to submit this material to the scientific journal of their choice, such as the *Canadian Journal of Plant Pathology* and *Phytoprotection.*

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Diagnostic Laboratories / Laboratoires diagnostiques

CROP: Commercial crops - Diagnostic Laboratory Report

LOCATION: British Columbia

NAME AND AGENCY:

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TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE BCMAFF PLANT DIAGNOSTIC LABORATORY IN 2000.

METHODS: The BCMAFF Plant Diagnostic Laboratory provides diagnosis and control recommendations for diseases and disorders of commercial agricultural crops grown in British Columbia. The following data reflect samples submitted to the laboratory by the Ministry extension staff, growers, agribusinesses, parks boards, and master gardeners. Diagnoses were accomplished by microscopic examination, culturing onto artificial media, biochemical identification of bacteria using BIOLOG® and serological testing for viruses and bacteria with micro-well and membrane based Enzyme-Linked Immunosorbent Assay (ELISA). Some specimens were forwarded to other laboratories for identification or confirmation of the diagnosis. The lab does not do soil nutrient, tissue nutrient or chemical residue analyses.

RESULTS AND COMMENTS: Summaries of the diseases and their causal agents diagnosed on commercial crops are presented in Tables 1-9 by crop category. The total number of submissions for each crop category is listed at the bottom of each table. Problems not listed include: no disease and abiotic problems such as nutritional stress, pH imbalance, water stress, poor sample, physiological response to growing conditions, environmental and chemical damage, insect-related injury and damage where no conclusive causal factor was identified.

Table 1. Summary of diseases diagnosed on **field crop** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2000.

CROP	DISEASE	CAUSAL ORGANISM	NO.
Corn	Common smut	*Ustilago maydis*	1
Helictotrichon sepervirens	Ergot	*Claviceps purpurea*	1
Orchard grass	Root rot	*Pythium* sp.	1
TOTAL DISEASED SAMPLES			3
TOTAL SUBMISSIONS			7

Table 2. Summary of diseases diagnosed on **greenhouse floriculture** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2000.

CROP	DISEASE	CAUSAL ORGANISM	NO.
Aphelandra sp.	INSV	INSV (Impatiens Necrotic Spot Virus)	1
Begonia sp.	INSV	INSV (Impatiens Necrotic Spot Virus)	2
	Stem rot	*Glomerella* sp.	1
Bergenia sp.	Foliar nematode	*Aphelenchoides* sp.	2
Bergenia cordifolia	Foliar nematode	*Aphelenchoides* sp.	1
Brassica oleracea var. acephala	Downy mildew	*Peronospora parasitica*	1
Calathea sp.	Leaf spot	*Helminthosporium* sp.	1
Chrysanthemum sp.	Root rot	*Pythium* sp.	1
	Stem rot	*Pythium* sp.	1
	Stem rot	*Rhizoctonia* sp.	1
Croton sp.	Root rot	*Rhizoctonia solani*	1
Dicentra formosa	Downy mildew	*Peronospora dicentrae*	1
Digitalis purpurea	Root rot	*Pythium* sp.	1
Dracaena sp.	Root rot	*Pythium*/*Phytophthora* spp.	1
	Soft rot	*Erwinia* sp.	1
	Stem rot	*Nectria haematococca*	1
Euphorbia pulcherrima	Basal stem rot	*Fusarium* sp.	1
	Botrytis canker	*Botrytis cinerea*	2
	Powdery mildew	*Oidium* sp.	1
	Root rot	*Pythium*/*Phytophthora* spp.	1
	Root rot	*Pythium* sp.	1
Ficus sp.	Root rot	*Rhizoctonia solani*	1
Hedera sp.	Crown and root rot	*Pythium and Rhizoctonia* sp.	1
	Leaf blight	*Xanthomonas hederae*	2
Helleborus foetidus	Root rot	*Pythium*/*Phytophthora* spp.	1
Hemerocallis sp.	Root rot	*Phytophthora* sp.	1
Heuchera sp.	Root rot	*Pythium*/*Phytophthora* spp.	1
Impatiens sp.	INSV	INSV (Impatiens Necrotic Spot Virus)	1
	Leaf spot	*Myrothecium roridum*	1
	TSWV	TSWV (Tomato Spotted Wilt Virus)	1
Iris sp.	Basal rot	*Fusarium oxysporum*	1
	Blue mold	*Penicillium* sp.	1
	Bulb rot	*Penicillium* sp.	1
Lilium sp.	Bulb rot	*Pythium* sp.	1
	Bulb rot	*Rhizoctonia* sp.	1
	Petal spot	*Botrytis* sp.	1
Limonium sp.	Downy mildew	*Peronospora* sp.	1
	Root rot	*Pythium* sp.	1
Lupinus sp.	Anthracnose	*Gloeosporium* sp.	1
	Anthracnose	*Colletotrichum* sp.	1
Narcissus sp.	Nematode damage	*Ditylenchus* sp.	1
Nemesia sp.	Bacterial blight	*Pseudomonas cichorii*	1

Continued

Table 2.. greenhouse floriculture crops- cont'd

CROP	DISEASE	CAUSAL ORGANISM	NO.
Paeonia suffruticosa	Leaf blotch	*Cladosporium* sp.	1
Petunia sp.	Black root rot	*Thielaviopsis basicola*	1
	Foliar blight	*Botrytis cinerea*	1
Pelargonium sp.	Bacterial blight	*Xanthomonas campestris* pv. *pelargonii*	1
	Leaf spot	*Pseudomonas syringae*	1
	Root rot	*Thielaviopsis basicola*	2
	Root rot	*Pythium* sp.	1
	Wire stem	*Rhizoctonia solani*	1
Phlox sp.	INSV	INSV (Impatiens Necrotic Spot Virus)	1
	Downy mildew	*Peronospora phlogina*	2
Plectranthus sp.	INSV	INSV (Impatiens Necrotic Spot Virus)	1
Ranunculus sp.	INSV	INSV (Impatiens Necrotic Spot Virus)	1
Rosa sp.	Stem & root rot	*Pythium/Phytophthora* spp.	1
Schizostylis coccinea	Leaf spot	*Heterosporium* sp.	1
Schlumbergera sp.	Erwinia blight	*Erwinia carotovora*	1
	Stem rot	*Fusarium* sp.	1
Senecio cruentus	INSV	INSV (Impatiens Necrotic Spot Virus)	1
Spathiphyllum sp.	INSV	INSV (Impatiens Necrotic Spot Virus)	1
Trillium ovatum	Anthracnose	*Colletotrichum* sp.	1
Tulipa sp.	Blue mold	*Penicillium* sp.	1
	Gray mold	*Botrytis* sp.	1
Verbena sp.	INSV	INSV (Impatiens Necrotic Spot Virus)	1
Viola sp.	Downy mildew	*Peronospora violae*	1
	Leaf spot	*Ramularia* sp.	1
TOTAL DISEASED SAMPLES			72
TOTAL SUBMISSIONS			116

Table 3. Summary of diseases diagnosed on **greenhouse vegetable** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2000.

CROP	DISEASE	CAUSAL ORGANISM	NO.
Cucumber	Stem rot	*Erwinia carotovora*	1
Pepper	INSV	INSV (Impatiens Necrotic Spot Virus)	1
	PMMV	PMMV (Pepper Mild Mottle Virus)	1
Tomato	Bacterial canker	*Clavibacter michiganensis* subsp. *michiganensis*	2
	Botrytis canker	*Botrytis cinerea*	1
	Foliar infection	*Penicillium* sp.	1
	Late blight	*Phytophthora infestans*	2
	Root rot	*Pythium* sp.	4
TOTAL DISEASED SAMPLES			13
TOTAL SUBMISSIONS			40

Table 4. Summary of diseases diagnosed on **nuts and small fruit** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2000.

CROP	DISEASE	CAUSAL ORGANISM	NO.
Walnut	Canker	*Cytospora* sp.	1
Blackberry	Downy mildew	*Peronospora sparsa*	1
Blueberry	Armillaria root rot	*Armillaria* sp.	1
	Bacterial blight	*Pseudomonas syringae*	4
	Blueberry Scorch Virus	Blueberry Scorch Virus*	1
	Canker	*Phomopsis* sp.	1
	Godronia canker	*Godronia cassandrae*	5
	Mummy berry	*Monilinia vaccinii-corymbosi*	2
	Root rot	*Phytophthora* sp.	5
Cranberry	Black rot	*Allantophomopsis* sp.	1
	Black rot	*Allantophomopsis cytisporea*	1
	End rot	*Godronia cassandrae*	1
	Leaf spot	*Protoventuria* sp.	4
	Leaf spot	*Colletotrichum* sp.	1
Raspberry	Blossom blight	*Botrytis cinerea*	1
	Crown and root rot	*Pythium/Phytophthora* spp.	1
	Crown and root rot	*Phytophthora* sp.	2
	Root rot	*Phytophthora fragariae*	1
	Root rot	*Phytophthora* sp.	3
	Spur blight	*Didymella applanata*	2
Salmonberry	Anthracnose	*Colletotrichum* sp.	1
Saskatoon	Canker	*Cytospora* sp.	1
Strawberry	Black root rot	*Phytophthora/Pythium/Rhizoctonia* spp.	2
	Red stele root rot	*Phytophthora fragariae*	2
	Verticillium wilt	*Verticillium albo-atrum*	1
TOTAL DISEASED SAMPLES			46
TOTAL SUBMISSIONS			76

* This is the first confirmed report of the presence of Blueberry Scorch Virus in BC. Following first submission, a survey was conducted to study the distribution of this virus in Lower Mainland. A total of 20 fields were infected.

Table 5. Summary of diseases diagnosed on **special crop** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2000.

CROP	DISEASE	CAUSAL ORGANISM	NO.
Basil	Stem canker	*Botrytis cinerea*	1
Ginseng	Crown rot	*Rhizoctonia solani*	1
	Foliar blight	*Alternaria panax*	1
	Powdery mildew	*Erysiphe* sp.	1
	Root rot	*Rhizoctonia solani*	1
	Root rot	*Phytophthora* sp.	1
Sea buckthorn	Wilt	*Verticillium dahliae*	1
TOTAL DISEASED SAMPLES			7
TOTAL SUBMISSIONS			10

Table 6. Summary of diseases diagnosed on **tree fruit** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2000.

CROP	DISEASE	CAUSAL ORGANISM	NO.
Apple	Apple scab	*Venturia inaequalis*	1
	Bacterial canker	*Pseudomonas syringae*	1
	Canker	*Cytospora* sp.	1
	Crown gall	*Agrobacterium tumefaciens*	1
	European canker	*Nectria galligena*	2
	Fire blight	*Erwinia amylovora*	2
	Root rot	*Phytophthora* sp.	1
Apricot	Bacterial blight	*Pseudomonas syringae*	3
	Fruit spot	Apricot Ring Pox *	1
Cherry	Bacterial canker	*Pseudomonas syringae*	2
	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium/Phytophthora* spp.	2
Grape	Root rot	*Pythium/Phytophthora* spp.	2
	Root rot	*Armillaria* sp.	1
	Crown gall	*Agrobacterium tumefaciens**	1
Peach	Bacterial blight	*Pseudomonas syringae*	1
Pear	European canker	*Nectria galligena*	1
Plum	Bacterial blight	*Pseudomonas syringae*	1
Plum (prune)	Rust	*Tranzschelia* sp.	1
Prunus spp.	Bacterial blight	*Pseudomonas syringae*	1
	Verticillium wilt	*Verticillium dahliae*	1
	Brown rot	*Monilinia* sp.	1
TOTAL DISEASED SAMPLES			29
TOTAL SUBMISSIONS			42

* The causal organism was suspected but not confirmed in the lab.

Table 7. Summary of diseases diagnosed on **turfgrass green, lawn and sod** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2000.

CAUSAL AGENT/DISEASE	**TYPE OF SAMPLE**		
	Green*	**Sod***	**Lawn***
Pythium sp./damping off	1		1
Pythium sp./root rot	13	1	1
Gaeumannomyces graminis/take-all patch	5		
Ascochyta sp./foliar blight	1		
Microdochium nivale/ fusarium patch	12		
Typhula ishikariensis/gray snow mold	1		
Colletotrichum graminicol/anthracnose	15		1
Colletotrichum sp./winter anthracnose	4		
Rhizoctonia cerealis /yellow patch	8		
Rhizoctonia sp./rhizoctonia patch		4	
Basidiomycete/localized dry spot	1		
Algae		3	
Sclerophthora sp./downy mildew	18		1
Leptosphaerulina sp./foliar blight		1	
Curvularia sp./foliar blight	1		
Septoria sp./leaf spot	3		
Spermospora sp./leaf spot		1	

* Greens are primarily creeping bentgrass and/or annual bluegrass samples from golf courses. Lawn and sod refer to mixtures of fescue, ryegrass, Kentucky bluegrass and annual bluegrass.

Table 8. Summary of diseases diagnosed on **field vegetable** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2000.

CROP	DISEASE	CAUSAL ORGANISM	NO.
Artichoke	Black lesions	*Pseudomonas syringae**	1
Cantaloupe	Leaf spot	*Pseudomonas syringae*	1
Celery	Late blight	*Septoria* sp.	1
Garlic	White rot	*Sclerotium cepivorum*	1
Onion	Downy mildew	*Peronospora destructor*	1
	Neck rot	*Botrytis allii*	1
	Smut	*Urocystis* sp.	2
	White rot	*Sclerotium cepivorum*	1
Parsnip	Leaf spot	*Ramularia* sp.	1
Pea	Damping off	*Pythium* sp.	1
	Root rot	*Pythium/Aphanomyces* spp.	1
Pepper	Vascular wilt	*Verticillium dahliae*	1
Potato	Black leg	*Erwinia carotovora* subsp. *atroseptica*	2
	Black scurf	*Rhizoctonia solani*	1
	Common scab	*Streptomyces scabies*	1
	Early blight	*Alternaria solani*	1
	Late blight	*Phytophthora infestans*	1
	Powdery scab	*Spongospora subterranea*	1
	Powdery scab	*Spongospora* sp.	1
	Russet scab	*Streptomyces* sp.	1
	Silver scurf	*Helminthosporium solani*	1
	Soft rot	*Erwinia carotovora* subsp. *carotovora*	4
Rhubarb	Red leaf spot	*Erwinia rhapontici*	1
Rutabaga	Crater rot	*Rhizoctonia solani*	1
Tomato	Canker	*Botrytis cinerea*	1
	Crown and root rot	*Fusarium oxysporum* f.sp. *radicis-lycopersici*	1
	Late blight	*Phytophthora infestans*	1
	Leaf mould	*Fulvia fulva*	1
	White mould	*Sclerotinia sclerotiorum*	1
	Powdery mildew	*Oidiopsis* sp.	2
TOTAL DISEASED SAMPLES			36
TOTAL SUBMISSIONS			53

* Confirmed the presence of the organism but no pathogenicity test was performed.

Table 9. Summary of diseases diagnosed on **ornamental** samples submitted to the BCMAFF Plant Diagnostic Laboratory in 2000.

CROP	DISEASE	CAUSAL	NO.
Abies grandis	Rust	*Uredinopsis* sp.	1
Abies pinsapo	Canker	*Phomopsis lokoyae*	1
Acer circinatum	Root rot	*Phytophthora/Pythium* spp.	1
Aconitum napellus	Root rot	*Phytophthora* sp.	1
Ajuga reptans	Crown rot	*Ascochyta* sp.	1
Alyssum sp.	Downy mildew	*Peronospora parasitica*	1
Amelanchier sp.	Canker	*Cytospora* sp.	1
Araucaria araucana	Leaf blight	*Cytospora* sp.	1
	Root rot	*Phytophthora* sp.	1
Arctostaphylos sp.	Anthracnose	*Glomerella cingulata*	1
	Bacterial blight	*Pseudomonas syringae*	1
	Leaf spot	*Colletotrichum acutatum*	1
	Root rot	*Phytophthora* sp.	1
Arctostaphylos uva-ursi	Canker	*Phomopsis* sp.	1
	Root rot	*Phytophthora/Pythium* spp.	1
Bergenia sp.	Leaf spot	*Gloeosporium* sp.	1
Buxus sp.	Root rot	*Phytophthora* sp.	1
Castanea sp.	Twig canker	*Cryptodiaporthe* sp.	1
Cedrus deodora	Armillaria root rot	*Armillaria* sp.	1
Clematis sp.	Stem rot	*Ascochyta clematidina*	1
Cornus sp.	Leaf spot	*Septoria* sp.	1
Crataegus sp.	Bacterial blight	*Pseudomonas syringae*	1
Daphne sp.	Marssonina leaf blight	*Marssonina* sp.	1
Fragaria sp.	Foliar nematode	*Aphelenchoides* sp.	1
Gaultheria shallon	Stem canker	*Diaporthe* sp.	1
Helleborus sp.	Root rot	*Pythium/Phytophthora* spp.	1
Ilex aquifolium	Leaf blotch	*Guignardia* sp.	1
Juniperus sp.	Armillaria root rot	*Armillaria* sp.	1
	Needle cast	*Lophodermium* sp.	1
	Root rot	*Phytophthora* sp.	1
	Root rot	*Pythium/Phytophthora* spp.	3
	Rust	*Gymnosporangium nelsonii*	1
	Twig dieback	*Phomopsis* sp.	1
Lithodora diffusa	Root rot	*Pythium/Phytophthora* & *Thielaviopsis* spp.	1
Magnolia sp.	Dieback	*Phomopsis* sp.	1
Mahonia sp.	Root rot	*Fusarium* sp.	1
Malus fusca	Root rot	*Fusarium* sp.	1
Penstemon sp.	Powdery mildew	*Erysiphe* sp.	1
Photinia sp.	Root rot	*Phytophthora/Pythium* spp.	1
Photinia fraseri	Leaf spot	*Entomosporium mespili*	1

Continued

Table 9.. ornamentals- continued

CROP	DISEASE	CAUSAL	NO.
Picea conica	Root rot	*Phytophthora* sp.	1
Picea pungens	Root rot	*Phytophthora* sp.	1
Pieris sp.	Leaf spot	*Phyllosticta* sp.	1
	Root rot	*Phytophthora* sp.	1
Pinus contorta	Needle cast	*Lophodermium* sp.	1
	Needle cast	*Lophodermella* sp.	1
	Root rot	*Phytophthora* sp.	1
Populus sp.	Foliar blight	*Venturia populina*	1
Populus tremuloides	Canker	*Cryptosphaeria lignyota*	1
	Trunk rot	*Phellinus tremulae*	1
Prunus sp.	Bacterial canker	*Pseudomonas syringae*	1
	Shot hole	*Coryneum* sp.	1
Prunus sp.	Bacterial blight	*Pseudomonas syringae*	1
Pseudotsuga menziesii	Crown and root rot	*Phytophthora* sp.	1
	Root rot	*Phytophthora* sp.	1
Quercus rubra	Anthracnose	*Discula* sp.	1
Rhododendron sp.	Anthracnose	*Glomerella cingulata*	1
	Anthracnose	*Colletotrichum* sp.	1
	Foliar blight	*Phytophthora/Pythium* spp.	1
	Powdery mildew	*Microsphaera* sp.	1
	Rust	*Chrysomyxa piperiana*	1
Ribes sanguineum	Crown and root rot	*Pythium/Phytophthora* spp.	1
Robinia sp.	Root rot	*Phytophthora/Pythium* spp.	1
Rosa sp.	Crown gall	*Agrobacterium tumefaciens*	1
Salix sp.	Anthracnose	*Gloeosporium* sp.	1
	Bacterial blight	*Pseudomonas syringae*	1
Sorbus sp.	Fire blight	*Erwinia amylovora*	1
	Root rot	*Pythium/Phytophthora* spp.	1
Spirea sp.	Leaf spot	*Phyllosticta* sp.	1
	Root rot	*Phytophthora* sp.	1
Taxus sp.	Root rot	*Pythium/Phytophthora* spp.	1
Thuja sp.	Root rot	*Phytophthora/Pythium* spp.	2
Thuja occidentalis	Leaf blight	*Kabatina thujae*	1
	Root rot	*Pythium/Phytophthora* spp.	2
	Root rot	*Phytophthora* sp.	10
Thuja plicata	Keithia blight	*Didymascella thujina*	1
	Root rot	*Phytophthora* sp.	1
Thuja pyramidalis	Foliar blight	*Kabatina thujae*	1
	Keithia blight	*Didymascella thujina*	1
Tilia sp.	Twig canker	*Phomopsis* sp.	1
Trifolium sp.	Rust	*Uromyces* sp.	1
TOTAL DISEASED SAMPLES			95
TOTAL SUBMISSIONS			190

Crop: Commercial Crops - Diagnostic Laboratory Report

Location: Alberta

Name and Agency:

K. Basu , S. Mathur and B.J. Penner
Brooks Diagnostics Limited
Crop Diversification Centre South, Brooks, Alberta, Canada T1R 1C5

Title: CROP DISEASE SUMMARY FOR SAMPLES SUBMITTED TO BROOKS DIAGNOSTICS LTD. FROM ALBERTA IN 2000

Methods: Brooks Diagnostics Limited (BDL), a private plant health clinic, provided diagnosis of diseases on commercial crops and other plants submitted by farmers, extension specialists, scientists, agribusinesses, market gardeners, florists, greenhouse growers, landscaping companies, municipal parks departments staff, nurseries, golf courses, and the general public from January 1 to August 30, 2000. The company closed its doors in September after being in business for seven years.

Results: Disease identifications from various crop categories are summarized in Tables 1-10, and are organized according to the region of submission. BDL also received samples with insect damage and from regions other than Alberta. These data are not included in this report.

Table 1. Summary of diseases diagnosed on **cereal crops** submitted to Brooks Diagnostics Ltd. in 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
Southern Alberta		
Barley	Spot blotch	*Cochliobolus sativus*
	Fusarium blight	*Fusarium avenaceum*
	Common root rot	*Cochliobolus sativus, Fusarium* spp.
	Spot form of net blotch	*Pyrenophora teres*
	Foliar yellowing	Physiological stress
Wheat	Foot rot/crown rot	*Fusarium spp.*Spot blotch*Fusarium spp.*
	Seedling blight	*Cochliobolus sativus*
	Root rot	*Rhizoctonia solani*
Northern Alberta		
Barley	Root rot	*Fusarium spp., Rhizoctonia solani*
	Spot blotch	*Cochliobolus sativus*
Wheat	Root rot/foot rot	*Fusarium sp., Rhizoctonia solani* Rhizoctonia root rot*Rhizoctonia solani*
	Seedling blight/damping-off	*Pythium spp., Fusarium spp., Cochliobolus sativus*

Table 2. Summary of diseases diagnosed on **field crops** submitted to Brooks Diagnostics Ltd. in 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
Southern Alberta		
Chickpea	Ascochyta blight	*Ascochyta rabiei*
South Central Alberta		
Field pea	Root rot, seedling blight	*Fusarium spp., Pythium spp., Rhizoctonia* spp.

Table 3. Summary of diseases diagnosed on **forage crops** submitted to Brooks Diagnostics Ltd. in 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
Southern Alberta		
Alfalfa	Leaf spot	*Stemphylium botryosum*
	Crown/root rot	*Fusarium roseum, Rhizoctonia solani*
	Spring blackstem and leaf spot	*Phoma medicaginis*
	White leaf spot	Physiological stress

Table 4. Summary of diseases diagnosed on **fruit trees** submitted to Brooks Diagnostics Ltd. in 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
Southern Alberta		
Apple	Fire blight	*Erwinia amylovora*
Saskatoon	Rust	*Gymnosporangium* spp.

Table 5. Summary of diseases diagnosed on **greenhouse crops** submitted to Brooks Diagnostics Ltd. in 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
Southern Alberta		
Begonia	Leaf spot	TSWV*
Cucumber	Angular leaf spot	*Pseudomonas syringae pv. lachrymans*
Peony	Suspect aster yellows	Aster yellows phytoplasma
Pepper	Tomato spotted wilt virus	TSWV*
Dieffenbachia	Anthracnose	*Colletotrichum gloeosporioides*
Dracaena	Fusarium leaf spot and stem rot	*Fusarium moniliforme*
Tropical Hoya	Tomato spotted wilt virus	TSWV*
South Central Alberta		
Geranium	Tomato spotted wilt virus	TSWV*
Gloxinia	Impatiens necrotic spot virus	INSV*
Zinnia	Tomato spotted wilt virus	TSWV*

* Disease confirmed by serological methods

Table 6. Summary of diseases diagnosed on **oilseed crops** submitted to Brooks Diagnostics Ltd. In 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
North Central Alberta		
Canola	Leaf purpling	Suspect herbicide damage
	Crown/Root Rot	*Fusarium sp./Rhizoctonia solani*

Table 7. Summary of diseases diagnosed on **specialty crops** submitted to Brooks Diagnostics Ltd. in 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
Southern Alberta		
Caraway	Sclerotinia rot	*Sclerotinia sclerotiorum*
Mint	Phoma stem rot	*Phoma* spp.

Table 8. Summary of diseases diagnosed on **turfgrass** submitted to Brooks Diagnostics Ltd. in 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
Southern Alberta		
Fairway	Pink snow mold	*Microdochium nivale*
	Pythium blight	*Pythium* spp.
Green	Pink snow mold	*Microdochium nivale*
	Pythium blight	*Pythium* spp.
	Melting out/leaf spot	*Drechslera poae*
	Fusarium patch	*Fusarium poae*
		Fusarium graminearum
		Fusarium equiseti
	Brown patch	*Rhizoctonia solani*
Lawn	Fairy ring	*Marasmius oreades*
South Central Alberta		
Green	Pink snow mold	*Microdochium nivale*
	Pythium blight	*Pythium* spp.
	Brown patch	*Rhizoctonia* spp.Anthracnose*Colletotrichum*
	Cottony snow mold	*Coprinus psychromorbidus*
	Melting out/leaf spot	*Drechslera poae*
	Fusarium patch	*Fusarium poae*
		Fusarium graminearum
		Fusarium culmorum
		Fusarium avenaceum
North Eastern Alberta		
Green	Leptosphaerulina leaf blight	*Leptosphaerulina trifolii*
North Western Alberta		
Fairway	Pythium blight	*Pythium* sp.
Green	Pink snow mold	*Microdochium nivale*
	Pythium blight	*Pythium* spp.

Table 9. Summary of diseases diagnosed on **vegetable crops** submitted to Brooks Diagnostics Ltd. in 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
Southern Alberta		
Corn	Seedling blight	*Fusarium* spp.
Potato	Verticillium wilt	*Verticillium albo-atrum*Early blight*Alternaria*
	Soft rot	*Erwinia carotovora* subsp.*carotovora*
	Dry rot	*Fusarium* spp.
	Leak	*Pythium ultimum*
	Vascular discoloration	Frost injury
	Stem end browning	Physiological stress
	Rot at vascular ring	*Fusarium solania*
	Powdery scab	*Spongospora subterranea*

Table 10. Summary of diseases diagnosed on **woody ornamental plants** submitted to Brooks Diagnostics Ltd. in 2000.

LOCATION/HOST	DISEASE/SYMPTOMS	CAUSAL AGENT
Southern Alberta		
Crabapple	Dieback/chlorosis	Heat stress
Mountain ash	Anthracnose	*Colletotrichum* spp.
	Cytospora canker	*Cytospora* spp.
Spruce	Dieback/needle browning	Environmental stress (poor drainage)Tip
	Rhizosphaera needle bight	*Rhizosphaera kalkhoffii*
	Fusarium root rot	*Fusarium oxysporum*
	Yellowing and purpling /needle desiccation	Environmental stress
South Central Alberta		
Pine	Brown Spot	*Scirrhia acicola*
Poplar	Marssonina leaf spot	*Marssonina populi*
	Bacterial wet wood	Bacteria

CROP: Commercial crops - Diagnostic Laboratory Report

LOCATION: Saskatchewan

NAME AND AGENCY:

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TITLE: DISEASES DIAGNOSED ON CROP SAMPLES SUBMITTED TO THE SASKATCHEWAN AGRICULTURE AND FOOD CROP PROTECTION LABORATORY IN 2000.

METHODS: Saskatchewan Agriculture and Food's (SAF) Crop Protection Laboratory provides diagnostic services and recommendations for crop health problems to the agricultural industry. Services include disease, insect and weed identification and testing of weeds for herbicide resistance. Samples are submitted to the Crop Protection Laboratory by SAF Extension Agrologists, growers, agribusiness and home gardeners. Disease diagnosis is accomplished by microscopic examination, culturing on artificial media, ELISA testing and BIOLOG™.

RESULTS: In 2000 the Crop Protection Laboratory received 1054 samples (April 1 - November 2, 2000) of which 75% were for disease diagnosis (39% of these were for Dutch elm disease). Other than Dutch elm disease, 34% cereals, 3% forages, 2% fruit, 10% oilseeds, 37% special crops, 2% vegetables and 10% woody ornamentals, herbaceous ornamentals, turf and greenhouse comprised the remainder. Summaries of diseases/causal agents diagnosed on crop samples submitted to the Crop Protection Laboratory in 2000 are presented in Tables 1-8 by crop category.

Table 1. Summary of plant diseases diagnosed on **cereal crops** submitted to the SAF Crop Protection Laboratory in 2000.

CROP	DISEASE/CAUSAL AGENT	NO. OF SAMPLES
Barley	Net blotch/*Pyrenophora teres*	6
	Common root rot/*Cochliobolus sativus, Fusarium* spp.	3
	Fusarium head blight/*Fusarium* spp.	3
	Spot blotch/*Cochliobolus sativus*	3
	Seedling blight/*Cochliobolus sativus, Fusarium* sp.	1
	Chemical injury	15
	Environmental injury	6
	Nutrient deficiency	4
	Physiological/genetic disorder	1
	Mechanical injury	1
Oats	Red top/Barley Yellow Dwarf Virus	2
	Leaf blotch/*Pyrenophora avenae*	2
	Leaf blotch/*Septoria avenae*	2
	Cephalosporium stripe/*Cephalosporium gramineum*	1
	Common root rot/*Fusarium* spp.	1
	False loose smut/*Ustilago nigra*	1
	Chemical injury	3
	Environmental stress	3
Rye	Nutrient deficiency	1
Wheat	Common root rot/*Cochliobolus sativus, Fusarium* spp.	22
	Septoria leaf blotch/*Septoria tritici, S. nodorum*	12
	Head blight/*Fusarium* spp.	10
	Prematurity blight/*Cochliobolus sativus, Fusarium* spp.	10
	Sooty molds/*Alternaria* spp., *Cladosporium* sp.	8
	Tan spot/*Pyrenophora tritici-repentis*	6
	Glume blotch/*Septoria nodorum*	5
	Leaf rust/*Puccinia recondita*	1
	Loose smut/*Ustilago tritici*	1
	Red smudge/*Pyrenophora tritici- repentis*	1
	Seedling blight/*Pythium* sp., *Fusarium* sp., *Cochliobolus* sp.	1
	Stem rust/*Puccinia graminis*	1
	Take all/*Ophiobolus graminis*	1
	Environmental injury	28
	Herbicide injury	20
	Nutrient deficiency	4

Table 2. Summary of plant diseases diagnosed on **forage crops** submitted to the SAF Crop Protection Laboratory in 2000.

CROP	DISEASE/CAUSAL AGENT	NO. OF SAMPLES
Alfalfa	Black stem/leaf spot/*Phoma medicaginis var. medicaginis*	3
	Root/crown rot/*Fusarium* spp., *Rhizoctonia solani*, Phoma sp., *Pseudomonas* sp.	2
	Leaf spot/*Stemphylium botryosum*	2
	Chemical injury	1
	Nutrient deficiency	1
Brome grass	Root rot/*Cochliobolus* sp., *Fusarium* sp.	1
Corn	Environmental stress	1
Sweet Clover	Environmental stress	1
Russian wild rye	Head blight/*Fusarium poae*	1
Timothy	Purple spot/*Cladosporium phlei*	1
	Leaf blotch/*Dreschlera phlei*	1
Wheat grass	Head blight/*Fusarium* spp.	2

Table 3. Summary of plant diseases diagnosed on **fruit crops** submitted to the SAF Crop Protection Laboratory in 2000.

CROP	DISEASE/CAUSAL AGENT	NO. OF SAMPLES
Apple	Polypore fungus/*Polyporaceae*	1
	Apple scab/*Venturia inaequalis*	1
	Pseudomonas syringae	1
Raspberry	Spur blight/*Didymella applanata*	1
Saskatoon	Fireblight/*Erwinia amylovora*	1
	Environmental injury	1

Table 4. Summary of plant diseases diagnosed on **oilseed crops** submitted to the SAF Crop Protection Laboratory in 2000.

CROP	DISEASE/CAUSAL AGENT	NO. OF SAMPLES
Canola	Root rot/*Fusarium* spp., Rhizoctonia solani	10
	Blackleg/*Leptosphaeria maculans*	4
	Alternaria blackspot/*Alternaria* spp.	4
	Damping off and seedling blight/*Pythium* sp.,	3
	Sclerotinia stem rot/*Sclerotinia sclerotiorum*	2
	Aster yellows/Aster yellows phytoplasma	2
	Downy mildew/*Peronospora parasitica*	1
	Chemical injury	12
	Nutrient deficiency	6
	Environmental stress	4
Flax	Chemical injury	4
Sunflower	Sclerotinia stem rot/*Sclerotinia sclerotiorum*	1
	Chemical injury	1

Table 5. Summary of plant diseases diagnosed on **special crops** submitted to the SAF Crop Protection Laboratory in 2000.

CROP	DISEASE/CAUSAL AGENT	NO. OF SAMPLES
Canary seed	Leaf mottle/*Septoria triseti*	2
	Chemical injury	1
	Environmental stress	1
Caraway	Root and crown rot/*Fusarium* spp., *Rhizoctonia*,	2
	Phytophthora sp. Alternaria blight/*Alternaria* sp.	1
	Fusarium blossom/seed blight/*Fusarium* sp.	1
Chickpea	Ascochyta blight/*Ascochyta rabiei*	28
	Sclerotinia stem rot/*Sclerotinia sclerotiorum*	2
	Seedling blight/*Fusarium* sp., *Rhizoctonia solani*	2
	Root rot/*Rhizoctonia solani*	1
	Botrytis pod rot/Botrytis cinerea	1
	Chemical injury	5
	Environmental stress	5
Coriander	Alternaria blight/*Alternaria* sp.	1
Dill	Phoma blight/*Phoma anethi*	1

Continued

Table 5.. **special crops** - cont'd

CROP	DISEASE/CAUSAL AGENT	NO. OF SAMPLES
Echinacea	Root rot/*Fusarium* spp., *Pythium* sp., Rhizoctonia solani	1
	Aster yellows/*Aster Yellows Phytoplasma*	1
Faba bean	Chocolate spot/*Botrytis cinerea*	1
Hop	Environmental stress	1
Lentil	Ascochyta blight/*Ascochyta lentis*	30
	Anthracnose/*Colletotrichum truncatum*	10
	Botrytis stem and pod rot/*Botrytis cinerea*	9
	Root rot/*Fusarium* spp., *Rhizoctonia solani*	8
	Stemphylium leaf blight/*Stemphylium botryosum*	5
	Sclerotinia stem rot/*Sclerotinia sclerotiorum*	1
	Secondary stem rot/*Fusarium* sp.	1
	Botrytis seed rot/*Botrytis cinerea*	1
	Penicillium seed rot/*Penicillium* sp.	1
	Chemical injury	15
	Environmental injury	14
	Physiological stress	1
Mint	Phoma root rot/*Phoma* sp.	2
	Fusarium root rot/*Fusarium* sp.	1
	Verticillium wilt/*Verticillium albo-atrum*	1
Mustard	Staghead/*Albugo candida*	1
	Chemical injury	2
Pea	Root rot/*Fusarium* spp., *Rhizoctonia solani*	8
	Mycosphaerella blight/Mycosphaerella pinodes	6
	Seedling blight/*Fusarium* spp.	1
	Thielaviopsis root rot/Thielaviopsis basicola	1
	Powdery mildew/Erysiphe pisi	1
	Secondary bacteria/*Pseudomonas viridiflava*	1
	Chemical injury	6
	Nutrient deficiency	3
	Environmental injury	2
Soybean	Chemical injury	1

Table 6. Summary of plant diseases diagnosed on **vegetable crops** submitted to the SAF Crop Protection Laboratory in 2000.

CROP	DISEASE/CAUSAL AGENT	NO. OF SAMPLES
Potato	Bacterial brown spot/*Pseudomonas syringae*	1
	Bacterial soft rot/*Erwinia carotovora*	1
	Dry rot/Fusarium solani	1
	Root rot/*Fusarium* sp.	1
	Chemical injury	2
	Greening/environmental stress	1
Squash	Grey mold/ *Botrytis cinerea*	1
	Fruit rot/Sclerotinia fuckeliana	1
Tomato	Late blight/*Phytophthora infestans*	2
	Bacterial speck/*Pseudomonas syringae*	1

Table 7. Summary of plant diseases diagnosed on **woody ornamental crops** submitted to the SAF Crop Protection Laboratory in 2000.

CROP	DISEASE/CAUSAL AGENT	NO. OF SAMPLES
Ash	Chemical injury	2
Caragana	Chemical injury	2
Cherry	Nutrient deficiency	1
Chokecherry	Shot hole/*Blumeriella jaapii*	1
	Chemical injury	1
	Environmental stress	1
Cotoneaster	Fireblight/*Erwinia amylovora*	3
Crabapple	Fireblight/*Erwinia amylovora*	2
Elm	Black leaf spot/*Gnomonia ulmea*	1
	Chemical injury	2
	Environmental stress	1
Juniper	Environmental stress	1
Lilac	Secondary bacteria/*Pseudomonas viridiflava*	1
Maple	Chemical injury	4
	Environmental stress	1
Oak	Root rot/*Fusarium* sp., *Cylindrocarpon* sp.	1
	Oak leaf curl/*Taphrina caerulescens*	1
Poplar	Cytospora canker/*Cytospora* sp.	3
	Phoma canker/*Phoma* sp.	1
	Phyllosticta Leaf Spot/*Phyllosticta* sp.	1
	Nutrient deficiency	1
Spruce	Root rot/*Phytophthora* sp., *Pythium* sp.	2
	Rhizosphaera needle cast/*Rhizosphaera kalkhoffii*	1
	Chemical injury	3
	Environmental stress	2
Willow	Environmental stress	1

Table 8. Summary of plant diseases diagnosed on **greenhouse and herbaceous ornamental crops** submitted to the SAF Crop Protection Laboratory in 2000.

CROP	DISEASE/CAUSAL AGENT	NO. OF SAMPLES
Poinsettia	Chemical injury	1
Godetia	Root rot/*Verticillium albo-atrum*	1
Turf	Root rot/*Fusarium* sp.	2
	Anthracnose/*Colletotrichum graminicola*	1
	Chemical injury	1
	Environmental stress	1

CROP: Commercial crops - Diagnostic Laboratory Report

LOCATION: Manitoba

NAME AND AGENCY:

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TITLE: 2000 MANITOBA CROP DIAGNOSTIC CENTRE LABORATORY SUBMISSIONS

METHODS: The Manitoba Agriculture and Food Crop Diagnostic Centre provides diagnoses and control recommendations for disease problems of agricultural crops and ornamentals. Samples are submitted by Manitoba Agriculture and Food extension staff, farmers, agri-business, and the general public. Diagnosis is based on visual examination for symptoms and culturing onto artificial media.

RESULTS: Summaries of diseases diagnosed on plants in different crop categories are presented in Tables 1-10.

Table 1. Summary of diseases diagnosed on **cereal crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Wheat	Septoria leaf spot	*Septoria* spp.	15
	Head blight	*Fusarium* spp	11
	Common root rot	*Fusarium* spp. *Cochliobolus sativus*	28
	Tan spot	*Pyrenophora tritici-repentis*	12
	Black head mould		6
	Ergot	*Claviceps purpurea*	1
	Glume blotch	Leptosphaeria nodorum	5
	Anthracnose	*Colletoichum graminicola*	1
	Yellow dwarf	Barley yellow dwarf virus	1
	Powdery mildew	*Erysiphe graminis* f. sp. *tritici*	3
	Wheat streak mosaic	Wheat streak mosaic virus	1
	Physiological leaf spot		15
	Herbicide injury		30
	Environmental injury		25
	Nutrient deficiency		5
Barley	Net blotch	*Pyrenophora teres*	3
	Common root rot	*Fusarium* spp. *Cochliobolus sativus*	5
	Fusarium head blight	*Fusarium* spp.	10
	Bacterial leaf blight	*Pseudomonas syringae*	3
	True loose smut	*Ustilago nuda*	1
	Spot blotch	*Cochliobolus sativus*	1
	Environmental injury		8
	Herbicide injury		24
	Nutrient deficiency		1
Oats	Red leaf	Barley yellow dwarf virus	2
	Bacterial blight	*Pseudomonas syringae*	2
	Head blight	*Fusarium* spp.	2
	Leaf rust	*Puccinia coronata*	1
	Septoria leaf spot	*Septoria avenae*	4
	Stem rot	*Puccinia graminis* f. sp.	1
	Common root rot	*Fusarium* sp.	1
	Environmental injury		3
	Nutrient deficiency		1
	Herbicide injury		2

Table 2. Summary of diseases diagnosed on **oilseed crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Flax	Fusarium root rot	*Fusarium* spp.	3
	Pasmo	*Septoria linicola*	1
	Seed and boll spot	*Alternaria* spp.	2
	Seedling blight	*Rhizoctonia solani*	1
	Environmental damage		7
	Herbicide injury		14
Sunflower	Sclerotinia wilt	*Sclerotinia sclerotiorum*	1
	Seedling blight	*Pythium* sp.	2
	Aster yellows	Aster yellows phytoplasma	1
	Stained kernels	*Alternaria zinniae*	1
	Herbicide injury		17
	Environmental injury		1
Canola	Blackleg	*Leptosphaeria maculans*	1
	Downy mildew	*Peronospora parasitica*	3
	Black spot	*Alternaria* spp.	2
	Stem rot	*Sclerotinia sclerotiorum*	4
	Root rot	*Pythium* spp., *Rhizoctonia* spp.	13
	Fusarium root rot	*Fusarium* spp.	1
	Aster yellows	Aster yellows phytoplasma	2
	Fusarium wilt	*Fusarium avenaceum*	1
	Herbicide injury		88
	Environmental injury		7
	Nutrient deficiency		3

Table 3. Summary of diseases diagnosed on **forage crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Alfalfa	Root rot	*Fusarium* spp.	2
	Spring black stem and leaf spot	*Phoma medicaginis*	9
	Botrytis blossom blight	*Botrytis cinerea*	1
	Common leaf spot	*Pseudopeziza medicaginis*	5
	Downy mildew	*Peronospora trifoliorum*	2
	Stemphylium leaf spot	*Stemphylium botryosum*	1
	Sclerotinia crown and stem rot	*Sclerotinia sclerotiorum*	4
	Alfalfa mosaic	Alfalfa mosaic virus	2
	Nutrient deficiency		1
	Environmental injury		2
	Herbicide injury		2
Trefoil	Stemphylium leaf spot	*Stemphylium botryosum*	1

Table 4. Summary of diseases diagnosed on **grass crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Lawn and Turf	Melting out	*Drechslera* spp	2
	Septoria leaf spot	*Septoria* sp.	1
	Fusarium patch	*Microdochium nivale*	4
	Leptosphaerulina leaf blight	*Leptosphaerulina* sp.	2
	Necrotic ring spot	*Leptosphaeria korrae*	1
	Powdery mildew	*Erysiphe graminis*	1
	Red thread	*Laetisaria fuciformis*	1
	Pythium blight	*Pythium* spp.	2
	Anthracnose	*Colletotrichum graminicola*	3
	Rust	*Puccinia* spp.	1
	Slime mould	*Physarum* spp.	1
	Environmental stress		2
Timothy	Brown leaf stripe	*Cercosporidium graminis*	4
	Fusarium root rot	*Fusarium* spp.	3
	Purple eye spot	*Heterosporium phlei*	3

Table 5. Summary of diseases diagnosed on **vegetable crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Cabbage	Blackleg	*Phoma lingam*	1
Carrot	Pythium root dieback	*Pythium* sp.	2
	Alternaria leaf blight	*Alternaria dauci*	3
Cauliflower	Blackleg	*Phoma lingam*	1
	Downy mildew	*Peronospora* sp.	1
Cucumber	Angular leaf spot	*Pseudomonas syringae* pv. *lachrymans*	1
Garlic	Blue mould	*Penicillium* sp.	2
Onion	Purple blotch	*Alternaria porri*	1
	Botrytis neck rot	*Botrytis* sp.	1
Pea	Ascochyta blight	*Ascochyta pisi*	2
	Root rot	*Fusarium* sp., *Rhizoctonia* sp.	1
	Sclerotinia stem rot	*Sclerotinia sclerotiorum*	1
	Powdery mildew	*Erysiphe pisi*	1
	Anthracnose	*Colletotrichum* sp.	1
	Bacterial blight	*Pseudomonas syringae*	1
Pepper	Bacterial leaf spot	*Xanthomonas campestris* pv. *vesicatoria*	1
Radish	Bacterial soft rot	Undetermined	1
Rutabaga	Blackleg	*Phoma lingam*	1
	Bacterial soft rot	Undetermined	1
	Aster yellows	Aster yellows phytoplasma	1
Tomato	Septoria leaf spot	*Septoria lycopersici*	3
	Late blight	*Phytophthora infestans*	6
	Bacterial speck	*Pseudomonas syringae*	1

Table 6. Summary of diseases diagnosed on **fruit crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Apple	Frogeye leaf spot	*Botryosphaeria obtusa*	1
	Canker	Unidentified	2
	Iron chlorosis	Nutrient deficiency	2
Crabapple	Frogeye leaf spot	*Botryosphaeria obtusa*	1
Raspberry	Anthracnose	*Elsinoe veneta*	2
	Fire blight	*Erwinia amylovora*	1
	Spur blight	*Didymella applanata*	1
	Downy mildew	*Peronospora* sp.	1
Strawberry	Root rot	*Fusarium* spp., *Pythium* spp., *Rhizoctonia* sp.	2
	Common leaf spot	*Mycosphaerella fragariae*	1
	Fruit rot	*Botrytis cinerea*	1
	Black root rot	*Pythium* sp.,*Fusarium* sp., *Rhizoctonia* sp.	3
	Powdery mildew	*Sphaerotheca macularis*	1
	Anthracnose	*Colletotrichum* sp.	1
Saskatoon	Brown rot	*Monilinia* sp.	1
	Entomosporium leaf and berry spot	*Entomosporium mespili*	1
	Canker	*Cytospora* spp.	1
	Root rot	*Fusarium* spp., *Pythium* spp., *Cylindrocarpon* spp.	2
	Black leaf	*Apiosporina collinsii*	1
Chokecherry	Shothole	*Blumeriella jaapii*	1
	Black knot	*Apiosporina morbosa*	1

Table 7. Summary of diseases diagnosed on **greenhouse crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Aconites	Blue mould	*Penicillium* sp.	1
	Storage rot	*Aspergillus* sp.	1
Begonia	Virus	Undetermined	1
	Grey mould	*Botrytis* spp.	1
	Powdery mildew	*Erysiphe* sp.	1
Columbine	Root rot	*Fusarium* sp.	1
	Grey mould	*Botrytis* sp.	1
Cotoneaster	Fire blight	*Erwinia amylovora*	1
Elder	Leaf spot	Undetermined	1
Fuschia	Root rot	*Pythium* sp.	1
Geranium	Bacterial leaf spot	Undetermined	1
	Root rot	*Pythium* sp.	1
	Verticillium wilt	*Verticillium* sp.	1
Hemerocallis	Bulb rot	*Fusarium* sp.	1
Hyacinth	Storage rot	*Aspergillus* sp.	2
	Blue mould	*Penicillium* sp.	2
Impatiens	Virus	TSWV	1
	Root rot	*Pythium* sp.	1
Iris	Grey mould	*Botrytis* sp.	1
Juniper	Canker	Undetermined	1
	Juniper rust	*Gymnosporangium nelsonii*	1
	Twig blight/canker	*Phomopsis* sp.	2
Lilac	Alternaria leaf spot	*Alternaria* sp.	1

Continued

Table 7.. greenhouse crops - cont'd

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Mistflower	Blue mould	*Penicillium* sp.	1
Monarda	Powdery mildew	*Erysiphe* sp.	1
Muscari	Blue mould	*Penicillium* sp.	1
Obedient plant	Storage rot	Undetermined	1
	Root rot	*Pythium* sp., *Fusarium* sp.	2
Peony	Leaf spot	*Cladosporium* sp.	1
Persian cornflower	Blue mould	*Penicillium* sp.	1
	Grey mould	*Botrytis* sp.	1
Petunia	Virus	Undetermined	1
	Root rot	*Rhizoctonia* sp.	1
Phlox	Virus	ISNV	1
	Storage rot	*Penicillium* sp.	1
Scabiosa	Storage rot	Undetermined	2
Scaveola	Root rot	*Pythium* sp.	1
Sedum	Powdery mildew	*Erysiphe* sp.	1
Statice	Aster yellows	Aster yellows phytoplasma	1
Tulip	Blue mould	*Penicillium* sp.	5
White snowdrops	Blue mould	*Penicillium* sp.	1
Yarrow	Blue mould	*Penicillium* sp.	1
Zinnia	Sclerotinia stem rot	*Sclerotinia* sp.	1

Table 8. Summary of diseases diagnosed on **potato crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Early blight	*Alternaria solani*	9
Silver scurf	*Helminthosporium solani*	2
Root rot	*Rhizoctonia solani*	3
Root rot	*Fusarium* spp.	2
Late blight	*Phytophthora infestans*	35
Fusarium wilt	*Fusarium* spp.	1
Verticillium wilt	*Verticillium dahliae*	18
Powdery scab	*Spongospora subterranea*	3
Bacterial soft rot	*Erwinia carotovora* subsp. *carotovora*	4
Black dot	*Colletotrichum coccodes*	9
Blackleg	*Erwinia carotovora* subs. *atroseptica*	3
Fusarium dry rot	*Fusarium* spp.	16
Scab	*Streptomyces scabies*	1
Botrytis	*Botrytis cinerea*	2
Leak	*Pythium* spp.	2
Leafroll	PLRV	1
Pink rot	*Phytophthora erythroseptica*	2
Blue mould	*Penicillium* sp.	2
Purple top	Aster yellows phytoplasma	1

Table 9. Summary of diseases diagnosed on shade and **shelterbelt trees** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

CROP	SYMPTOMS/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Ash	Anthracnose	*Gloeosporium aridum*	4
	Leaf rust	*Puccinia sparganioides*	2
Aspen	Neofabraea	*Neofabraea* sp.	1
Elm	Dutch elm disease	*Ophiostoma ulmi*	14
	Canker	Undetermined	4
Maple	Vascular impairment	Undetermined	1
Oak	Anthracnose	*Apiognomonia quercina*	1
Pine	Canker	Undetermined	2
Poplar	Canker	*Cytospora* sp.	
	Root rot	Undetermined	1
	Slime flux	*Erwinia nimipressuralis*	1
Russian olive	Canker	Undetermined	1
Snowberry	Leaf spot	Undetermined	1
Spruce	Root rot	*Pythium* sp.	2
	Needle cast	*Rhizosphaera* sp., *Lirula* sp.	18
	Cytospora canker	*Leucostoma kunzei*	2
	Canker	Undetermined	7
	Sooty mould	Undetermined	1
	Rust	*Chrysomyxa* sp.	1
Willow	Canker	*Cytospora* sp.	1
	Root rot	Undetermined	1

Table 10. Summary of diseases diagnosed on **special field crops** submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre in 2000.

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Buckwheat	Blossom necrosis	*Fusarium* sp., *Alternaria* sp.	5
	Charcoal rot	*Macrophomina phaseolina*	1
	Root rot	*Fusarium* sp.	1
	Botrytis flower blast	*Botrytis* sp.	1
Chickpea	Root rot	*Fusarium oxysporum*	1
Coriander	Stem and flower blight	*Alternaria* sp., *Fusarium* sp.	1
Corn	Northern corn leaf	*Setosphaeria turcica*	1
	Root rot	Undetermined	1
Cranberry	Bacterial blight	Pseudomonas syringae	
Echinacea	Aster yellows	Aster yellows phytoplasma	1
Faba bean	Root rot	Undetermined	2
	Alternaria leaf spot	*Alternaria* sp.	1
	Fusarium root rot	*Fusarium* sp.	2
	Leaf spot	*Stemphylium* sp.	1
	Chocolate spot	*Botrytis* sp.	2
Field bean	Root rot	*Fusarium* sp.	7
	Root rot	*Rhizoctonia* sp.	2
	Root rot	Undetermined	3
	Leaf spot	*Septoria sp.*	5
	Leaf spot	*Stemphylium* sp.	1
	Common blight	*Xanthomonas campestris* pv. *phaseoli*	18
	Halo blight	*Pseudomonas syringae* pv. *phaseolicola*	8
	Rust	*Uromyces appendiculatus*	1
	Anthracnose	*Colletotrichum lindemuthianum*	12
	White mould	*Sclerotinia* sp.	2
	Black pod spot	*Alternaria* sp.	2
	Ascochyta blight	*Ascochyta* sp.	1
	Alternaria leaf spot	*Alternaria* sp.	2

Continued

Table 10.. Special field crops - cont'd

CROP	SYMPTOM/ DISEASE	CAUSAL AGENT	NO. OF SAMPLES
Field pea	Root rot	*Fusarium* spp., *Fusarium oxysporum*, *Fusarium avenaceum*, *Rhizoctonia* sp.	3
	Mycosphaerella blight	*Mycosphaerella pinodes*	1
	White mould	*Sclerotinia* sp.	1
	Anthracnose	*Colletotrichum* sp.	1
Hemp	Sclerotinia stem rot	*Sclerotinia sclerotiorum*	2
	Root rot	*Fusarium* sp.	1
	Stem rot	*Fusarium* sp.	
	Aster yellows	Aster yellows phytoplasma	1
Lentil	Root rot	*Fusarium* sp.	1
	Fusarium blight	*Fusarium avenaceum*	3
	Fusarium stem rot	*Fusarium* sp.	2
	Sclerotinia stem rot	*Sclerotinia* sp.	2
	Anthracnose	*Colletotrichum* sp.	2
Soybean	Bacterial blight	*Pseudomonas syringae* pv. *glycinea*	2
	Fusarium stem and root rot	*Fusarium* sp.	2
	Slime mould	Undetermined	1

CROP: Diagnostic Laboratory Report - Commercial Crops

LOCATION: Québec

NAME AND AGENCY:

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TITLE: DISEASES DIAGNOSED ON COMMERCIAL CROPS SUBMITTED TO THE MAPAQ DIAGNOSTIC LABORATORY IN 2000

METHODS: The objective of the MAPAQ diagnostic laboratory is to provide diagnosis and control recommendations for disease problems of commercial crops. The following data reflect diagnoses of samples submitted to the laboratory by extension staff of MAPAQ, the "Régie des assurances agricoles du Québec", the "Institut québécois du développement de l'horticulture ornementale" and by the agricultural industry. Diagnosis is based on visual examination of symptoms and on the use of various laboratory tests to detect and to identify pathogens. The following tests are used in the laboratory; for nematodes, isolation with the Baermann funnel and microscope examination; for fungi, isolation on artificial media, microscope examination and pathogenicity testing; for bacteria, isolation on artificial media, classical biochemical tests including API-20E and Biolog®, ELISA and PCR tests; for phytoplasmas, PCR tests and for viruses, ELISA tests.

RESULTS AND COMMENTS: The distribution of crop samples was: vegetable crops 25.9%, greenhouse vegetables 11.6%, storage vegetables 3.8%, small fruit 26.5%, apple trees 2.5%, perennials and woody ornamentals 7.0%, greenhouse ornamentals 13.3%, cereal crops 3.5%, herbs 1.3% and other crops 4.3%. Problems not listed include insect related injury, pathogen detection in substrates and asymptomatic plants, damage where no conclusive disease-causing organism was identified and seed problems.

ACKNOWLEDGEMENT: The authors gratefully thank Carolle Fortin, Chantal Malenfant, Mario Tésolin and Lise Vézina for technical assistance.

Table 1. Summary of **vegetable field crop** diseases diagnosed by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Asparagus	Fusarium wilt and root rot	1
	Stemphylium blight	1
Bean	*Fusarium oxysporum*	1
	Fusarium solani	1
	Potyvirus	2
	Pythium root rot	1
	Sclerotinia rot	2
	Oedema	1
	Wind injury	1
Broccoli	*Peronospora parasitica*	1
	Pythium sp.	1
	Erwinia carotovora subsp. *carotovora*	1
	Pseudomonas syringae	1
	Xanthomonas campestris pv. *armoraciae*	3
	Xanthomonas campestris pv. *campestris*	1
	Brown bud	3
	Nicosulfuron injury	1
Cabbage	*Alternaria brassicicola*	3
	Pythium crown rot	3
	Rhizoctonia solani	2
	Sclerotinia sclerotiorum	2
	Erwinia carotovora subsp.*carotovora*	2
	Pseudomonas cichorii	2
	Xanthomonas campestris pv. *armoraciae*	2
	Xanthomonas campestris pv. *campestris*	2
	Mineral deficiencies (Ca, Mg)	2
	Water deficit	1
Cantaloup	*Fusarium equiseti*	1
	Fusarium solani	1
	Sclerotinia sclerotiorum	1
	Pseudomonas syringae	2
Carrot	*Cercospora carotae*	1
	Cylindrocarpon sp.	1
	Fusarium solani	
	Pythium sp. (cavity spot)	1
	Rhizoctonia solani	1
	Xanthomonas campestris pv. *carotae*	1
	Meloidogyne sp.	2
	Linuron injury	1

Continued

Table 1.. vegetable field crop - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Cauliflower	*Alternaria brassicicola*	1
	Peronospora parasitica	1
	Rhizoctonia solani	1
	Xanthomonas campestris pv. *armoraciae*	1
Celery	Pythium root rot	3
	Pseudomonas fluorescens	1
	Pseudomonas syringae	1
Chinese cabbage	*Rhizoctonia solani*	1
Corn	*Bipolaris* sp.	1
	Fusarium spp.	3
	Fusarium graminearum	5
	Puccinia sorghi	5
	Pythium root rot	1
	Pseudomonas syringae	1
	Acid soil	1
	Aluminum toxicity	1
	Excessive water	1
	Glyphosate injury	1
	Late frost	1
	Imazethapyr injury	1
Cucumber	Alternaria leaf spot	2
	Phytophthora capsici	1
	Pythium crown rot	2
	Rhizoctonia fruit rot	1
	Sclerotinia sclerotiorum	1
	Verticillium sp.	1
	Pseudomonas syringae	4
	Cold injury	1
Garlic	Fusarium bulb rot	1
	Pythium sp.	1
	Sclerotium cepivorum	1
	Potyvirus	2
	Sun burn	1
Leek	*Fusarium oxysporum*	1
	Pseudomonas marginalis	1
	Pseudomonas syringae	3
Lettuce	*Botrytis cinerea*	1
	Bremia lactucae	3
	Rhizoctonia basal rot	1
	Pythium root rot	2

Continued

Table 1.. vegetable field crop - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Lettuce	*Pseudomonas marginalis*	1
	Pseudomonas syringae	1
	Xanthomonas campestris pv. *vitians*	4
	Ammonia toxicity	2
	Boron toxicity	2
	Water stress	2
Onion	Botrytis neck rot	3
	Fusarium basal rot	6
	Peronospora destructor	3
	Phytophthora cinnamomi	1
	Sclerotinia sclerotiorum	1
	Stemphylium botryosum	5
	Pseudomonas syringae	1
	Pseudomonas viridiflava	1
	Harvest injury	1
	Lightning injury	1
	Phenoxy injury	1
	Wind injury	1
Pea	*Erysiphe* sp.	2
	Fusarium oxysporum	1
	Pythium root rot	1
	Glyphosate injury	1
Pepper	*Botrytis cinerea*	1
	Phytophthora capsici	1
	Pythium root rot	1
	Sclerotinia sclerotiorum	2
	Clavibacter michiganensis subsp. *michiganensis*	1
	Pseudomonas syringae	10
	Magnesium deficiency	1
	Phenoxy injury	2
	Sun burn	1
Potato	*Alternaria solani*	3
	Botrytis cinerea	1
	Colletotrichum coccodes	2
	Fusarium tuber rot	2
	Helminthosporium solani	1
	Phytophthora infestans	2
	Pythium tuber rot	3
	Rhizoctonia solani	7
	Spongospora subterranea	1
	Clavibacter michiganensis subsp. *sepedonicus*	4
	Erwinia carotovora subsp. *carotovora*	7

Continued

Table 1.. vegetable field crop - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Potato	Streptomyces spp.	2
	Verticillium sp.	7
	Pratylenchus	1
	PLRV	1
	TSWV	1
	Black heart	1
	Calcium deficiency	1
	Glufosinate injury	1
	Heat necrosis	1
	Late frost damage	1
	Manganese toxicity	1
Pumpkin	*Cladosporium cucumerinum*	5
	Fusarium fruit spot	4
	Oïdium sp.	1
	Phoma cucurbitacearum	1
	Septoria cucurbitacearum	2
	Erwinia carotovora subsp. *carotovora*	1
	Pseudomonas syringae	6
	CMV	2
	TSWV	1
	Heat stress	1
	Light Stress	2
	Oedema	1
	Wind injury	1
Radish	*Peronospora parasitica*	1
	Pythium root rot	1
	Rhizoctonia solani	2
Rutabaga	Cylindrocarpon root rot	1
Squash	*Fusarium oxysporum* (wilt)	2
	Sclerotinia sclerotiorum	1
	Septoria cucurbitacearum	1
	Pseudomonas syringae	2
Tomato	*Alternaria solani*	1
	Botrytis cinerea	1
	Fusarium crown rot	1
	Phytophthora infestans	9
	Sclerotinia sclerotiorum	1
	Thielaviopsis sp.	1
	Clavibacter michiganensis subsp. *michiganensis*	6
	Pseudomonas syringae pv. *tomato*	2
	Cold injury	1
	Glyphosate injury	2
	Phenoxy injury	1

Continued

Table 1.. **vegetable field crop** - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Watermelon	*Fusarium oxysporum* (wilt)	1
	Phoma cucurbitacearum	1
	Verticillium sp.	1
	Cold injury	1
	Wind injury	1
TOTAL SUBMISSIONS		301

Table 2. Summary of **greenhouse vegetable** diseases diagnosed by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Cucumber	*Didymella brioniae*	1
	Penicillium canker	1
	Phoma cucurbitacearum	3
	Phomopsis cucurbitae	1
	Pyrenochaeta sp.	1
	Pythium root rot	3
	Rhizoctonia solani	1
	Sclerotinia sclerotiorum	2
	Verticillium sp.	1
	Erwinia tracheiphila	1
	CMV	6
	TSWV	5
	Salt damage	1
	Sun burn	1
Lettuce	*Botrytis cinerea*	1
	Bremia lactucae	1
	Oïdium sp.	1
	Pythium root rot	8
	Pseudomonas cichorii	1
	Pseudomonas marginalis	1
	Fertilizer burn	1
	Salt damage	1
	Iron deficiency	1
Pepper	Botrytis stem rot	1
	Pythium root rot	1
	Clavibacter michiganensis subsp. *michiganensis*	1
	Pseudomonas syringae	1

Continued

Table 2.. greenhouse vegetable - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Tomato	Acremonium stem canker	1
	Botrytis cinerea	12
	Colletotrichum coccodes	2
	Fulvia fulva	1
	Fusarium oxysporum f. sp. *radicislycopersici*	3
	Humicola root rot	3
	Phytophthora cinnamomi (root rot)	1
	Phytophthora infestans	3
	Pyrenochaeta lycopersici	3
	Pythium root rot	12
	Sclerotinia sclerotiorum	1
	Verticillium albo-atrum	5
	Erwinia carotovora subsp. *carotovora*	1
	Clavibacter michiganensis subsp. *michiganensis*	15
	Pseudomonas corrugata	1
	TSWV	3
	Blossom end rot	1
	Blotchy ripening	1
	Gold speck	2
	Iron deficiency	1
	Manganese toxicity	1
	Oedema	1
	Phenoxy injury	1
	Russeting	2
	Salt injury	7
	Water stress	2
	Zinc toxicity	2
TOTAL SUBMISSIONS		136

Table 3. Summary of **storage vegetable** diseases diagnosed by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Carrot	*Alternaria radicina*	2
	Botrytis cinerea	2
	Cylindrocarpon sp.	2
	Fusarium solani	1
	Phytophthora sp.	1
	Pythium sp.	4
	Rhizoctonia carotae	3
	Pseudomonas marginalis	1
Cole crops	*Alternaria brassicicola*	3
	Fusarium rot	1
	Pseudomonas marginalis	1
	Black midrib	2
	Black speck	2
	Necrotic spot	1
	Oedema	1
Potato	*Colletotrichum coccodes*	1
	Fusarium dry rot	4
	Helminthosporium solani	1
	Phoma sp.	1
	Rhizoctonia solani	3
	Clavibacter michiganensis subsp. *sepedonicus*	1
	Erwinia carotovora subsp. *carotovora*	2
	After cooking browning	1
	Heat necrosis	1
	Hollow heart	2
	Jelly end rot	1
TOTAL SUBMISSIONS		45

Table 4. Summary of **small fruit** diseases diagnosed by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Blueberry	*Botrytis cinerea*	1
	Godronia cassandrae (*Fusicoccum*)	5
	Pucciniastrum goeppertianum	1
	Septoria sp.	1
	ToRSV	1
	Paraquat injury	1
	Salt injury	5
	Winter damage	3
Cranberry	*Godronia cassandrae* (*Fusicoccum*)	1
	Pestalotiopsis sp.	1
	Phomopsis vaccinii	2
	Protoventuria leaf spot	4
	Rhizoctonia root rot	2
	Aluminum toxicity	1
	Spring frost damage	1
Grape	*Oïdium tuckeri*	1
	Phyllosticta ampelicida	1
	Plasmopara viticola	1
	Sphaceloma ampelinum	2
	Agrobacterium sp.	1
	Early frost	1
	Late frost	1
	MCPA injury	1
	Phenoxy injury	1
Strawberry	*Botrytis cinerea*	2
	Cylindrocarpon root rot	11
	Diplocarpon earliana	3
	Fusarium root rot	2
	Hainesia lythri	1
	Idriella root rot	1
	Phytophthora cactorum	5
	Phytophthora fragariae	1
	Phytophthora spp.	21
	Pyrenochaeta sp.	8
	Pythium root rot	26
	Ramularia brunnea	3

Continued

Table 4. . **small fruit** - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Raspberry	*Armillaria mellea*	1
	Botrytis cinerea	2
	Coniothyrium fuckelii	2
	Didymella applanata	2
	Cylindrocarpon root rot	13
	Fusarium wilt	3
	Phragmidium rubi-idaei	1
	Phytophthora root	33
	Pucciniastrum americanum	1
	Pyrenochaeta root rot	5
	Pythium root rot	8
	Rhizoctonia root rot	5
	Sphaceloma necator (*Elsinoe veneta*)	10
	Septoria rubi	1
	Verticillium spp.	2
	Yeast fruit rot	1
	Agrobacterium rubi	1
	Agrobacterium tumefaciens	3
	Pseudomonas syringae	1
	Pratylenchus sp.	8
	Dichlobenil injury	1
	Glyphosate injury	1
	Hail damage	1
	pH imbalance	3
	Sun burn	2
	Winter damage	23
Total submissions		310

Table 5. Summary of **herbaceous (annuals and perennials) and woody ornamental** diseases diagnosed by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Acer spp.	*Discula* sp.	1
	Taphrina dearnessii	2
	Water stress	2
Amaranthus sp.	Pythium root rot	1
	Pseudomonas syringae	1
Aster sp.	*Basidiophora entospora*	1
Begonia sp.	*Botrytis cinerea*	1
	Oïdium	1

Continued

Table 5. . herbaceous (annuals and perennials) and woody ornamental - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Browallia sp.	Pythium root rot	2
Campanula sp.	*Phoma* sp.	1
	Pythium root rot	1
	Salt damage	1
Canna sp.	Potyvirus	1
Catalpa sp.	*Phomopsis* sp.	1
Chrysanthemum sp.	*Phoma* sp.	1
	Pythium root rot	1
Cornus sp.	*Septoria* sp.	1
Daphne sp.	*Botrytis cinerea*	1
Delphinium sp.	Pythium root rot	1
	Rhizoctonia root rot	2
Dicentra sp.	Pythium root rot	1
Echinacea sp.	Pythium root rot	1
Eryngium sp.	*Sclerotinia sclerotiorum*	1
Fraxinus pennsylvanica	*Phyllactinia guttata*	1
Hemerocallis sp.	*Phytophthora* sp.	2
Juniperus sp.	*Phomopsis juniperovora*	1
	Rhizoctonia root rot	1
	Sphaeropsis sp.	1
Lilium sp.	Botrytis leaf spot	1
Livistona sp.	Cold injury	1
Paeonia sp.	Botrytis leaf spot	1
	Cylindrocarpon root rot	1
	Rhizoctonia root rot	1
Petunia sp.	*Sclerotinia sclerotiorum*	1
Physocarpus sp.	*Sphaerotheca* sp.	1
Picea sp.	*Melampsorella caryophyllacearum*	1

Continued

Table 5. . herbaceous (annuals and perennials) and woody ornamental - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Pinus spp.	*Sphaeropsis sapinea*	1
	Winter injury	1
Platanus occidentalis	*Discula* sp.	1
Rosa spp.	ApMV	1
	PNRSV	1
	Manganese deficiency	1
Rhododendron sp.	*Pucciniastrum vaccinii*	1
Salix sp.	*Cytospora* sp.	1
Salvia sp.	*Sclerotinia sclerotiorum*	1
Sedum sp.	Rhizoctonia root rot	1
Syringa vulgaris	*Phytophthora* sp.	1
	Verticillium sp.	3
	Pseudomonas syringae	1
	Mineral toxicities (Cu, Mn, Zn)	3
Thuja occidentalis	Cylindrocarpon root rot	4
	Fusarium root rot	4
	Pestalotiopsis funerea	3
	Pyrenochaeta root rot	1
	Pythium root rot	3
	Mechanical injury	2
	pH imbalance	1
	Water excess	1
Tilia cordata	*Cercospora microsora*	1
	Water stress	2
Ulmus americana	*Ophiostoma ulmi*	1
TOTAL SUBMISSIONS		78

Table 6. Summary of diseases on **greenhouse ornamental plants** diagnosed by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Acorus sp.	Septocylindrium leaf spot	1
Ajuga reptans	Rhizoctonia root rot	1
	AMV	1
	CMV	1
	pH imbalance	1
Alternanthera sp.	Rhizoctonia leaf rot	2
Argyranthemum sp.	*Agrobacterium tumefaciens*	3
Astilbe sp.	Pythium root rot	1
Begonia sp.	*Oïdium* sp.	1
	INSV	3
	Pythium root rot	1
Calibracoa sp.	Thielaviopsis root rot	1
	Verticillium dahliae	1
	TMV	1
	ToMV	1
	Salt damage	1
Centaurea sp.	Pythium root rot	1
	Salt injury	1
Chrysanthemum sp.	*Botrytis cinerea*	1
	Rhizoctonia root rot	1
Coleus sp.	INSV	12
	Potyvirus	1
Cosmos bipinnatus	Entyloma leaf spot	1
Dianthus sp.	*Colletotrichum* sp.	1
	Pseudomonas syringae	1
Dracaena sp.	Fusarium root rot	2
Eichhornia crassipes	*Pseudomonas delphinii*	1
	Pythium root rot	1
Euphorbia pulcherrima	*Botrytis cinerea*	1
	Rhizoctonia root rot	1
	Sphaceloma sp.	1
	Acid soil	1
	Salt injury	1

Continued

Table 6.. greenhouse ornamental plants - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Gardenia sp.	Cylindrocarpon root rot	1
Gerbera jamesonii	Fusarium root rot	2
	Verticillium sp.	1
Hibiscus syriacus	Cladosporium leaf spot	1
	Pythium root rot	1
	Thielaviopsis root rot	1
	pH imbalance	1
Hosta sp.	*Botrytis cinerea*	1
Hydrangea sp.	Salt injury	1
	pH imbalance	1
Impatiens sp.	Rhizoctonia root rot	1
	INSV	12
	pH imbalance	1
	Water excess	1
Kalanchoe sp.	*Botrytis cinerea*	1
	INSV	1
Lobelia sp.	pH imbalance	1
Lisianthus sp.	Pythium root rot	1
Lychnis chalcedonica	INSV	1
Monarda fistulosa	INSV	1
	Salt injury	1
Nemesia sp.	INSV	1
Pelargonium sp.	*Botrytis cinerea*	1
	Pythium black leg	6
	Agrobacterium tumefaciens	1
	Erwinia carotovora subsp. *carotovora*	1
	PFBV	12
	Acid soil	1
	Iron toxicity	1
	Manganese toxicity	1
	Oedema	3
	Salt injury	2
	Water excess	2

Continued

Table 6.. greenhouse ornamental plants - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Pericallis sp.	INSV	1
Petunia sp.	TMV	1
	ToMV	1
Philodendron sp.	INSV	1
Physalis alkekengi	*Entyloma* sp.	2
Phlox sp.	Septoria sp.	1
	CMV	1
	INSV	1
	Potyvirus	1
Piper hispidium	Water stress	1
Polemonium sp.	CMV	1
	INSV	1
Portulaca sp.	Pythium root rot	1
	Salt damage	1
Pothos sp.	INSV	1
Rosa sp.	Coniothyrium canker	1
Rhododendron sp. (*azalea*)	Cylindrocladium root rot	1
	Water stress	1
Solanum sp.	CMV	1
	Acid soil	1
Surfinia sp.	CMV	1
	ToMV	2
	Potyvirus	1
	Verticillium dahliae	1
Tradescantia sp.	Potyvirus	1
Tulbaghia sp.	INSV	1
Verbena sp.	Pythium root rot	1
	INSV	2
Veronica sp.	INSV	1
Vinca sp.	*Rhizoctonia*	1

Continued

Table 6.. greenhouse ornamental plants - cont'd

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Viola sp.	*Botrytis cinerea*	1
	Sun burn	1
Zantedeschia sp.	*Erwinia carotovora* subsp. *carotovora*	1
	Salt injury	1
TOTAL SUBMISSIONS		157

Table 7. Summary of **apple** diseases diagnosed by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Apple	Alternaria leaf spot	2
	Botrytis cinerea	1
	Cytospora canker	2
	Phomopsis canker	2
	Phytophthora cactorum	1
	Pythium root rot	1
	Rhizoctonia root rot	1
	Sphaeropsis malorum	1
	Spilocaea pomi	5
	Tubercularia sp.	2
	Erwinia amylovora	4
	Boron deficiency	1
	CO^{2} injury	1
	Manganese deficiency	1
	Scald	2
	Spring frost damage	1
	Water excess	1
	Winter injury	1
TOTAL SUBMISSIONS		30

Table 8. Summary of **cereal crop** diseases diagnosed by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Barley	*Bipolaris sorokiniana*	2
	Dreschlera teres	2
	Erysiphe graminis	1
	Fusarium head blight	2
	Puccinia sp.	1
	Septoria sp.	1
	Ustilago sp.	1
Oats	*Bipolaris sorokiniana*	1
	Puccinia coronata	3
	Septoria avenae	2
	BYDV	7
	Manganese deficiency	1
Wheat	*Bipolaris sorokiniana*	1
	Cladosporium seed spot	1
	Fusarium head blight	5
	Gaeumannomyces graminis	3
	Puccinia graminis	3
	Septoria tritici	2
Corn	Cladosporium seed spot	1
	Fusarium stem rot	1
	Pythium root rot	1
	Acid soil	1
	Glyphosate injury	1
	Magnesium deficiency	1
	Manganese deficiency	1
	Nicosulfuron injury	1
TOTAL SUBMISSIONS		41

Table 9. Summary of **herb** diseases diagnosed by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Basil	*Fusarium oxysporum*	2
	INSV	2
	Cold injury	1
Coriander	Alternaria leaf spot	1
	Pseudomonas syringae	2
	Pseudomonas viridiflava	1
Marjoram	Rhizoctonia root rot	1
Mint	*Puccinia* sp.	1
	Rhizoctonia root rot	1
Oregano	Rhizoctonia root rot	1
Parsley	*Alternaria radicina*	1
Rosemary	Pythium root rot	1
	Phytophthora nicotiana	1
Thyme	Rhizoctonia root rot	1
TOTAL SUBMISSIONS		16

Table 10. Summary of diseases diagnosed on **other crops** by the MAPAQ diagnostic laboratory in 2000.

CROP	CAUSAL AGENT/DISEASE	NO. OF SAMPLES
Alfalfa	*Ascochyta* sp.	1
	Fusarium root rot	1
	Pseudopeziza medicaginis	2
	Boron deficiency	2
	Winter damage	1
Soybean	Colletotrichum crown rot	3
	Corynespora cassiicola	1
	Fusarium root rot	11
	Peronospora manshurica	2
	Phomopsis sp.	1
	Phytophthora root and crown rot	3
	Pythium root rot	3
	Rhizoctonia solani	4
	Septoria glycines	2
	Pseudomonas syringae	1
	Paratylenchus sp.	2
	Dicamba injury	3
	Hail damage	1
	Manganese deficiency	1
	Metolachlor injury	1
	Nicosulfuron injury	1
Tobacco	Alternaria leaf spot	2
	Pythium root rot	1
	Rhizoctonia root rot	1
	Thielaviopsis root rot	1
	Pratylenchus sp.	1
	Weather fleck	2
TOTAL SUBMISSIONS		55

Cereals / Céréales

CULTURES / CROPS : Avoine *Avena sativa*, Orge *Hordeum vulgare*, Blé *Triticum aestivum*

RÉGION / LOCATION : Québec

NOM ET ORGANISME / NAME AND ORGANIZATION:

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TITRE / TITLE : **SURVOL DES MALADIES DES CÉRÉALES PRÉSENTES AU QUÉBEC EN 2000**

INTRODUCTION ET MÉTHODES : La majorité des essais de céréales de printemps du réseau d'enregistrement et recommandation du Québec ont été visitée une fois entre la mi-juillet et la mi-août dans le but de noter l'incidence des maladies des parties aériennes. On a aussi prélevé des racines et des épis dans des champs d'orge et de blé à divers endroits au Québec afin d'étudier les pourritures racinaires et d'évaluer le taux d'infection des épis causée par les *Fusarium* spp. En général, les plantes examinées lors des visites des essais étaient au stade de développement laiteux moyen et celles dont les épis ont été prélevés, étaient au stade pâteux moyen. Pour les pourritures racinaires, les prélèvements ont été fait entre 2 et 6 semaines après le semis et on a isolé les agents pathogènes à l'aide de milieux sélectifs.

RÉSULTATS et COMMENTAIRES : L'année 2000 se caractérise par un printemps difficile (température et précipitations) ce qui a occasionné un retard dans les semis dans la plupart des régions. La saison a également été plus fraîche et pluvieuse dans le centre et dans sud-ouest du Québec, alors qu'à l'est de La Pocatière les premières pluies après le semis ont été suivies d'une longue sécheresse.

Bien que la saison 2000 ait été beaucoup plus pluvieuse que la normale dans les régions visitées, la fusariose de l'épi (*Fusarium graminearum* principalement) a eu une incidence relativement faible : le pourcentage d'épillets fusariés était de 3,6 % chez le blé (région de Montréal : 4,0%; région Centre-Québec : 2,1%) et de 5,5 % chez l'orge (région de Montréal : 6,1%; région Centre-Québec 5,5%). On peut peut-être expliquer ce résultat par les températures fraîches de la saison qui ont dû favoriser le développement d'espèces fongiques mieux adaptés au climat frais que le *F. graminearum*.

Chez l'avoine, la tache ovoïde (*Stagonospora avenae*) était la maladie foliaire la plus répandue. Son incidence a été plus marquée à Normandin que dans les autres stations où l'intensité des symptômes était plutôt moyenne. La rouille couronnée (*Puccinica coronata*) était assez intense à Sainte-Anne-de-Bellevue dans le sud-ouest de la province, comme c'est souvent le cas. Elle était présente aussi à La Pocatière, mais à un degré moindre. Le virus de la jaunisse nanisante de l'orge (VJNO) a touché toutes les régions du Québec, bien que faiblement dans la plupart des cas.

Chez le blé, la tache auréolée (*Drechslera tritici-repentis*) et la tache causée par *Phaeospheria nodorum*, appelée communément septoriose, ont été encore cette année les maladies foliaires les plus répandues avec un niveau d'infection modéré. La rouille des feuilles (*Puccinia recondita*) a été observée dans presque toutes les régions du Québec et son incidence a été estimée à moyenne; ce qui est plus élevée qu'à l'habitude. Un autre fait marquant, le VJNO s'est manifesté dans toutes les régions. Les symptômes ont même pu être notés à l'Acadie, Princeville et Hébertville. On estime des dommages dans certains champs allant de 5 à 10 %. Quant à l'oïdium, causé par *Erysiphe graminis*, il est apparu de façon sporadique à l'état de trace, mais à Princeville l'intensité des symptômes était plus élevée. Le piétin brun (*Pythium* spp.) a été la maladie racinaire dominante de la saison. On a aussi observé du piétin échaudage (*Gaeumannomyces graminis*) à la station de Pintendre.

Chez l'orge, la rayure réticulée (*Drechslera teres*) était prédominante partout au Québec. La rouille des feuilles (*Puccinia hordei*), quant à elle, a eu une incidence faible à moyenne là où elle a été observée, soit aux stations situées dans la vallée du Saint-Laurent. L'oïdium qui est une maladie peu courante au Québec, n'a en effet été observée qu'à La Pocatière, la station visitée la plus à l'est. Pour certains cultivars, l'infection a même atteint la feuille étendard. Le VJNO, tout comme chez le blé, a été très présent cette année. Il a même été observé en Gaspésie, dans la vallée de la Matapédia. La rhynchosporiose (*Rhynchosporium secalis*) que l'on retrouve certaines années était quasi absente en 2000. Quant aux maladies racinaires, le piétin brun était dominant tout comme chez le blé, mais a causé des pertes plus graves. On pense que dans certains champs, des pertes excédant 50 % étaient dues en grande partie aux *Pythium*.

CROP / CULTURE: Barley

LOCATION / RÉGION: Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF BARLEY IN SASKATCHEWAN IN 2000

INTRODUCTION AND METHODS: The incidence and severity of fusarium head blight (FHB) were assessed in 42 2-row and 21 6-row barley fields from 18 crop districts (CD) in Saskatchewan. Heads from 50 plants, at milk to dough stages, were collected randomly from each field and sent to the Crop Protection Laboratory in Regina for disease assessment, and pathogen isolation and identification. An FHB index (percent number of heads affected x mean severity of infection/100) was determined for each field. An average FHB index for infected fields in each CD, and for CDs grouped by soil zone (Zone I=Brown, Zone II=Dark Brown and Zone III=Black/Grey soils) was calculated. Kernels from heads with symptoms were surface sterilized in 10% Javex solution for 1 minute and plated on potato dextrose agar for identification of *Fusarium* spp.

RESULTS AND COMMENTS: Overall, 75% of barley fields surveyed were affected by FHB, a higher percentage than in 1999 (65%) or 1998 (59%) (Table 1; Fernandez et al. 1999; 2000). However, the mean FHB index was lower in 2000 (0.6%) than in 1999 (1.0%) or 1998 (1.4%). In 2000, the incidence of FHB was lower for 2-row (67%) than 6-row (90%) barley (Table 1). Conversely, the average FHB index was higher for 2-row (0.9%) than 6-row (0.2%) barley. This is similar to results from the 1999 survey. The mean FHB index was highest in crop districts 1B, 2B (south-east) and 5A (east-central). Individual fields with the highest FHB index (1.4% to 7.8%) were found in CDs 1B, 2B, 5A and 9B (north-west). The proportion of affected fields and their average FHB index was lowest in Zone I (south-west).

Fusarium sporotrichioides was isolated from the greatest number of fields, followed by *F. poae* and *F. avenaceum* (Table 1). *Fusarium culmorum* and *F. graminearum* were present in few fields. *F. sporotrichioides* was more prevalent in 2000 (77% of fields) than in 1999 (40%) or 1998 (22%).

We gratefully acknowledge the participation of Saskatchewan Agriculture and Food extension agrologists in this survey, and financial support by the Agriculture Development Fund.

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Fernandez, M.R, G. Holzgang, M.J. Celetti, and G. Hughes, 1999. The incidence of fusarium head blight in barley, common wheat and durum wheat grown in Saskatchewan during 1998. Can. Plant Dis. Surv. 79: 79-82. (http://res2.agr.ca/london/pmrc/report/disease99.html)

Table 1. Incidence and severity (FHB index) of fusarium head blight in 2-row and 6-row barley, and frequency of isolation of *Fusarium* spp. in Saskatchewan in 2000.

Soil zone/ Crop district	**No. affected fields/total fields**		**FHB index**[1]		***Fusarium* spp.**					
	2-row	6-row	2-row	6-row	*avenaceum*	*culmorum*	*equiseti*	*graminearum*	*poae*	*sporotrichioides*
Zone I										
3 BN	1 /2	-	0.8	-	1	-	1	-	-	-
3 BS	0 /1	-	-	-	-	-	-	-	-	-
4 A	0 /1	-	-	-	-	-	-	-	-	-
4 B	0 /1	-	-	-	-	-	-	-	-	-
7 A	1 /3	-	0.1	-	1	-	-	-	-	-
Total or mean:	2 /8	-	0.5	-	2	0	1	0	0	0
Zone II										
1 A	-	1 /1	-	0.1	-	1	-	1	-	1
2 A	-	1 /1	-	0.4	-	-	-	-	1	1
2 B	3 /3	1 /1	1.2	0.7	2	1	-	1	4	3
6 A	3 /3		0.5	-	-	-	-	-	2	2
6 B	3 /3	1 /1	0.4	0.1	1	-	-	-	2	3
7 B	2 /4	-	0.3	-	-	0	1	-	1	-
Total or mean:	11 /13	4 /4	0.6	0.3	3	2	1	2	10	10
Zone III										
1 B	1 /1	-	1 /4	-	-	-	-	1	1	1
5 A	2 /2	3 /3	5.8	0.2	3	1	-	2	5	4
5 B	4 /5	3 /4	0.3	0.2	1	-	2	-	3	7
8 A	0 /2	3 /4	-	0.2	1	-	-	-	3	3
8 B	1 /3	1 /1	0.4	0.3	1	-	1	-	-	1
9 A	1 /2	5 /5	0.1	0.2	1	-	3	-	2	5
9B	6 /6	-	0.6	-	6	-	1	-	1	6
Total or mean:	15 /21	15 /17	1.2	0.2	11	1	7	3	15	25
Overall total or mean:	28 /42	19 /21	0.9	0.2	16	3	9	5	25	36
Overall % fields:					34%	6%	19%	11%	53%	77%

[1] FHB index calculated as (percent number of heads affected x mean severity of infection)/100.

CROP / CULTURE: Barley

LOCATION / RÉGION: Manitoba

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: SURVEY FOR LEAF SPOT DISEASES OF BARLEY IN MANITOBA IN 2000

INTRODUCTION AND METHODS: Foliar diseases of barley in Manitoba were assessed by surveying 78 farm fields (21 two-row, 57 six-row) from July 24 to August 3 when most crops were at the milky to soft dough stage of growth (ZGS 72-89). Fields were sampled at regular intervals along survey routes, depending on availability. Disease severity was recorded by sampling approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Severity ratings were taken on both the upper (flag and penultimate leaves) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Infected leaves with typical symptoms were collected at each site, dried and stored in paper envelopes. Surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify the causal agent(s) and determine the disease(s) present.

RESULTS AND COMMENTS: Conditions in Manitoba in 2000 were relatively dry and cool early in the growing season (to early June) but then became warmer and considerably wetter to mid September, by which time most barley had been harvested. Leaf spot development was therefore somewhat delayed and in most cases did not become overly damaging, particularly as many crops were seeded early. As noted in former reports, the field history, i.e., presence or absence of barley stubble from the previous year, appeared to have the most influence on the level of leaf spotting observed.

Leaf spots were observed in the upper and/or lower leaf canopies of all barley fields surveyed. Disease severities in the upper canopy were nil, trace or very slight in 31% of fields, slight in 51%, moderate in 13%, and severe or leaves senescent in 5%. Respective severity categories in the lower canopy were tabulated as 4%, 41%, 23%, and 32%. These results are almost identical to those found in 1999. On this basis, foliar diseases in barley caused relatively little damage in 2000; on average, grain yield losses were likely in the range of 2-3%.

Pyrenophora teres and *Cochliobolus sativus*, causal agents of net blotch and spot blotch, respectively, were most frequently isolated from infected leaf tissue, and were responsible for most of the leaf spotting recorded (Table 1). *Septoria passerinii* (speckled leaf blotch) was recovered from about 1/4 of the fields, but caused relatively little of the damage observed. *Rhynchosporium secalis* (scald) was detected in two fields, and *Stagonospora nodorum* was found in 6 fields, causing less than 2% of the damage. The predominance of *P. teres* and *C. sativus* as leaf spot pathogens of barley in Manitoba in 2000 was typical of most years.

Table 1. Prevalence and isolation frequency of leaf spot pathogens of barley in Manitoba in 2000

PATHOGEN	PREVALENCE (% OF FIELDS)	DAMAGE (% OF ISOLATIONS)
Pyrenophora teres	84.6	52.4
Cochliobolus sativus	76.9	40.3
Septoria passerinii	25.6	5.4
Stagonospora nodorum	7.7	1.6
Rhynchosporium secalis	2.6	0.3

CROP / CULTURE: Barley

LOCATION / RÉGION: Manitoba and south-eastern Saskatchewan

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF BARLEY IN MANITOBA AND SOUTH-EASTERN SASKATCHEWAN IN 2000

INTRODUCTION AND METHODS: A total of 78 barley fields (21 two-row, 57 six-row) in southern Manitoba and south-eastern Saskatchewan were surveyed for the presence of fusarium head blight (FHB) between July 24 and August 3, 2000. Fields were selected randomly along the survey routes. FHB incidence (the percentage of heads with typical symptoms) in each field was assessed by sampling 80-100 spikes at 3 locations for disease. FHB severity (the average affected proportion of symptomatic heads) was estimated visually in the field. Thirty heads with FHB symptoms were collected at each field site, placed in plastic bags, and subsequently frozen. A total of 50 kernels, discoloured (putatively infected) whenever possible, and/or normal in appearance to make up the remainder, were removed from five heads per location. The kernels were surface sterilized in 0.3% NaOCl and plated onto potato dextrose agar to quantify and identify *Fusarium* spp. on the seed.

RESULTS AND COMMENTS: Conditions initially were unfavourable (cool and little precipitation) for development of FHB in Manitoba in 2000, but frequent rains beginning in mid-June, subsequently led to widespread and sometimes severe development of the disease. Fusarium head blight was found in 77 of 78 fields surveyed. Average incidence of FHB in two-row crops was 20% (range 6 - 83%) and severity also averaged 20% (range 1 - 66%); in six-row crops incidence was 33% (range 0 - 72%) and severity 16% (range 0 - 38%). The 2-row data are skewed somewhat as a result of very high incidence and severity values in one two-row field that was badly lodged. The resulting average FHB Index (incidence X severity / 100) was 3.9% (range 0.3 - 55%) for two-row and 5.4% (range 0 - 38%) in six-row barley. Based on these levels of incidence and severity, FHB was estimated to have caused yield losses averaging about 2% in barley in 2000, in the region surveyed. A comparison of FHB levels in the 8 south-eastern Saskatchewan barley fields surveyed with those from Manitoba, indicated considerably lower values for average incidence, severity and FHB Index (FHBI) in Saskatchewan (SK - incidence 12%, severity 6%, FHBI 0.7%; MB - incidence 32%, severity 17%, FHBI 5.5%). The *Fusarium* species isolated from kernels are shown in Table 1. As in the past several years, *F. graminearum* was the predominant pathogenic species. Levels of *F. graminearum* were lower, and those of *F. poae* and *F. avenaceum* higher, in south-eastern Saskatchewan compared to Manitoba.

Table 1. *Fusarium* spp. isolated from barley kernels in Manitoba and S.E. Saskatchewan in 2000.

***Fusarium* spp.**	**PERCENT OF FIELDS**		**PERCENT OF KERNELS**	
	MB	**MB**	**MB**	**SK**
F. graminearum	92.1	75	93	59.9
F. poae	34.4	87.5	3.8	28.9
F. avenaceum	19.7	62.5	1.7	5.3
F. sporotrichioides	21.1	12.5	0.9	1.3
F. equiseti	10.5	12.5	0.5	1.3
F. culmorum	2.6	12.5	0.1	3.3

CROP/CULTURE: Barley

LOCATION / RÉGION: Eastern Canada

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: BARLEY YELLOW DWARF OF BARLEY IN EASTERN CANADA IN 2000

INTRODUCTION AND METHODS: In Quebec, barley yellow dwarf (BYD) was moderately abundant in the Lac St-Jean area and more damaging in the Matapedia valley. On the Central Experimental Farm (Ottawa ON), BYDV infection was considered to be the most severe in ten years. This article reports cultivar responses in barley to the BYD epidemic at the Central Experimental Farm.

Forty-nine barley cultivars or advanced breeding lines from Eastern Canada were seeded on May 31, 2000 at the Central Experimental Farm in a randomized complete block design with four replications for screening for reactions to fusarium head blight. The seeding rate was 22 seeds m^{-2}. Each experimental plot consisted of two 1.5-m rows with a row spacing of 15 cm. When leaves of some seedlings turned yellow between the veins, BYDV infection was suspected. On July 19 all of the experimental plots were rated on a scale of 0 to 9 with 0 being no leaf chlorosis and 9 being severe leaf chlorosis. To confirm the presence of BYDV, leaf samples of three cultivars (ACCA, AC Legend, and AC Maple) were collected on August 1 for an ELISA test for the PAV strain of barley yellow dwarf virus.

RESULTS AND COMMENTS: The ELISA test showed that the optical densities of ACCA leaf samples (0.040 and 0.084) were lower than those of AC Maple (0.087 and 0.266) and AC Legend (0.161 and 0.188) leaf samples. The leaf samples were collected from 2-month-old plants, thus considerable force might be required to extract the virus from these old and lignified tissues. We could have obtained more virus from these samples if they had been ground several times. The results suggest the presence of a significant amount of BYDV in AC Maple and AC Legend. The 49 barleys differed in reactions to BYD with ACCA being most resistant. ACCA carries the BYDV resistance gene *Yd2*. On average, two-row cultivars were more susceptible to BYDV than six-row cultivars (2.54 vs. 1.94, $P<0.05$). Bright yellow leaf chlorosis was also observed in the seed multiplication plots at the Central Experimental Farm. The ratings of leaf chlorosis for the 13 barleys in the multiplication plots were as follows: AC Klinck 1, AB186-3 2, Morrison 2, AC Alberte 4, AC Hamilton 4, AC Parkhill 4, AC Stephen 4, AB214-2 4, OBS4181-43 4, AC Legend 5, OBS4840-1 5, OBS4065-157 5, and AC Maple 6.

Table 1. Barley yellow dwarf (BYD) reactions of 49 barley cultivars grown at Ottawa in 2000.

SIX-ROW BARLEY	BYD[z]	TWO-ROW BARLEY	BYD
ACCA	0.00	Formosa	1.50
AC Alma	0.75	AB233	1.75
Brucefield	1.00	AC Alberte (hulless)	1.75
Hamilton	1.00	AB230	2
Nellygan	1.00	AC Queens	2.00
Sandrine	1.00	AC Kings	2.25
AB186-3	1.25	Morrison	2.25
Excel	1.25	AB214-2	2.5
AC Stephen	1.25	Almonte	2.50
AC Westech	1.25	Belmore	2.50
B1602	1.50	AC Sirius	2.50
AC Klinck	1.50	AC Sterling	2.75
Leger	1.50	Viking	2.75
OBS4347-23	1.50	AC Parkhill	3.00
OBS4985-1	1.50	Symko	3.00
Grant	1.75	Serena	3.25
AC Malone	1.75	AB235-2	3.50
AC Burman	2.00	Sunderland	4.00
OBS4984-6	2.00		
OAC Kippen	2.25		
Myriam	2.25		
OBS4755-1	2.25		
Stander	2.25		
Chapais	2.50		
Chevron	2.50		
OBS4181-43	2.50		
OBS4840-1	2.75		
Viviane	3		
AB197-4	4		
AC Legend	4.25		
AC Maple	4.75		

[z] 0 = no leaf chlorosis, 9 = severe leaf chlorosis. LSD (0.05) = 0.96.

CROPS / CULTURES: Barley and Oat

LOCATION / RÉGION: Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: LEAF DISEASES OF BARLEY AND OAT IN SASKATCHEWAN IN 2000

INTRODUCTION AND METHODS: A survey of leaf diseases of barley and oat was conducted in fields randomly selected from most crop districts (CD) in Saskatchewan. Ten flag and ten penultimate leaves were collected at random from each of 51 fields of barley and 29 fields of oat at the late-milk to early-dough stages of development. The leaves were air-dried at room temperature. The percent leaf area diseased (severity) and number of fields affected (prevalence) were calculated for each CD. At the time of rating, the identify of diseases present, based on visual inspection, was also recorded.

RESULTS AND COMMENTS: Leaf spot diseases were found in all barley and oat fields surveyed (Table 1). While moisture conditions were generally favourable to disease development, except in the north-west region of the province, the cool weather experienced in the first half of the growing season appeared to slow disease development so that disease levels were similar to or slightly lower than those in 1999. The average leaf spot severity on flag leaves was trace (<5%) in 12%, slight to moderate (5-25%) in 58%, moderate (26-50%) in 17% and severe (>50%) in 13% of fields surveyed. Disease levels tended to be fairly similar across all crop districts. Leaf spot disease severity in oat was low with the highest levels occurring in the east-central region (CDs 5A, 5B). Most fields had trace or slight levels of disease.

The most common leaf disease in barley was net blotch, caused by *Pyrenophora teres*. Spot blotch (caused by *Cochliobolus sativus*) was the next most common disease and scald (caused by *Rhynchosporium secalis*) was detected on leaf samples from 4 fields in north-western Saskatchewan (CDs 9A, 9B). Plating of leaf samples will be done to confirm these observations and to identify the cause of the oat leaf spots. Crown rust was not found in any oat field.

We gratefully acknowledge the participation of Saskatchewan Agriculture and Food extension agrologists in this survey and financial support from the Saskatchewan Agriculture Development Fund.

Table 1. Distribution and severity of leaf spotting diseases of barley and oat in Saskatchewan fields surveyed at late milk to early-dough stages in 2000.

CROP DISTRICT	BARLEY		OAT	
	% fields affected/ surveyed	Mean severity[1] (%)	# fields affected/ surveyed	Mean severity (%)
1 B	1 /1	62	1 /1	19
2 A	1 /1	5	2 /2	7
2 B	5 /5	26	1 /1	1
3B-N	1 /1	46	1 /1	1
3B-S	1 /1	1	1 /1	1
4 A	2 /2	14	1 /1	3
5 A	3 /3	14	2 /2	16
5 B	7 /7	26	5 /5	15
6 A	1 /1	11	- -	- -
6 B	3 /3	21	2 /2	8
7 A	2 /2	13	1 /1	1
7 B	5 /5	16	1 /1	1
8 A	9 /9	15	2 /2	10
8 B	1 /1	51	4 /4	6
9 A	4 /4	12	2 /2	9
9 B	4 /4	28	3 /3	8
Total	51 /51		29 /29	
Mean		23		

[1] Percent flag leaf area diseased.

CROPS / CULTURES: Barley, Oat and Wheat

LOCATION / RÉGION: Manitoba and eastern Saskatchewan

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TITLE / TITRE: **STEM RUSTS OF CEREALS IN WESTERN CANADA IN 2000**

INTRODUCTION AND METHODS: Surveys of fields and trap nurseries of barley, oat and wheat for incidence and severity of stem rust *(Puccinia graminis* Pers. f. sp. *tritici* Eriks. & E. Henn. and *P. graminis* Pers. f. sp. *avenae* Eriks. & E. Henn.) were conducted in July, August, and September 2000. Infected stem tissue samples obtained from fields and trap nurseries were evaluated for pathotypic specialization on appropriate sets of host differential lines.

RESULTS AND COMMENTS: Environmental conditions were unfavorable for stem rust infection, with low temperatures and frequent rainfall. Stem rust severity on susceptible lines in trap nurseries was at very low levels (<5%) in 2000. All spring wheat cultivars recommended for Manitoba and Saskatchewan have excellent resistance to stem rust, and no stem rust infection was observed in any commercial fields. Barley and oat cultivars recommended for Manitoba and Saskatchewan are susceptible to stem rust infection (Pathotypes QCCJ and NA67, respectively). Little or no stem rust infection was observed in early-planted barley and oat fields. This may be due to escape from infection, unfavorable environmental conditions, or to application of foliar fungicides. In 2000, a significant percentage of cereal fields in eastern Manitoba were sprayed with fungicides for control of foliar and head diseases, which additionally controlled stem rust. Low to moderate levels of infection developed during late summer-early fall on late-planted oat fields, wild barley *(Hordeum jubatum* L.), and wild oat *(Avena fatua* L.).

No new pathotypes of *P. graminis* f. sp. *tritici* were found to threaten Canadian wheat or barley production. The most serious stem rust threat is the continued increase in frequency of pathotypes NA67 and NA76 of *P. graminis* f. sp. *avenae*. These pathotypes are virulent on the effective stem rust resistance genes *(Pg2, Pg9,* and *Pg13)* deployed in Canadian oat cultivars. Since the advent of pathotype NA67 in 1998, the frequency of this pathotype in the oat stem rust population in the eastern prairie region on Canada has risen from about 20% to near 40% in 2000. These two races now threaten oat production in the rust area of the prairies. Identification and incorporation of genes conferring resistance to NA67 and NA76 are underway in the Agriculture and Agri-Food Canada, Cereal Research Centre breeding programs.

CROPS / CULTURES: Barley, Oat and Wheat

LOCATION / RÉGION: Manitoba and eastern Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: CEREAL VIRUS DISEASE SITUATION IN MANITOBA IN 2000

INTRODUCTION AND METHODS: Virus diseases on cereals in Manitoba monitored in 2000 were barley yellow dwarf (BYD), wheat streak mosaic (WSM) and flame chlorosis (FC). Collaborators identified and collected samples from early June to late August in cereal crops in Manitoba and parts of eastern Saskatchewan. The proportion of plants with (suspected) virus symptoms in surveyed fields was estimated and specimens with and without symptoms collected for testing. Infection with BYDV and WSMV was confirmed by transmission to indicator hosts, and for BYDV, also characterized as to serotype by enzyme-linked immunosorbent assay (ELISA). In addition to confirming identity of causal agents, transmission to indicator host plants was used to assess virulence against historical benchmarks. For WSMV, transmission was by mechanical inoculation to a range of susceptible spring bread and durum wheat hosts; for BYDV, transmission was by cereal aphids to sets of seedlings of a susceptible oat host.

RESULTS AND COMMENTS:

Barley Yellow Dwarf (BYD) - Unlike 1999 (1), losses due to BYD were generally very mild. Cereal aphid populations carrying BYDV were not in evidence in Manitoba until late June, which is similar to most years. Compared to 1999, the proportion of early-arriving cereal aphids that were oat bird-cherry (*Rhopalosiphum padi*), the most efficient vector of the predominant BYDV strain, PAV, was lower and roughly similar to that seen in most years. Although losses were generally mild, there were areas of noticeable losses in later-seeded barley in western Manitoba (near Brandon) and in barley and oat in some areas near Saskatoon. Losses due to BYD in wheat were very small. Consistent with the trend of the last 15-20 years, almost all virus isolates obtained from small grains were of the PAV strain (non-specifically transmitted by the oat bird-cherry aphid).

Wheat Streak Mosaic (WSM) - Localized outbreaks of WSM in spring wheat crops in Manitoba and eastern Saskatchewan in 2000 occurred in the vicinity of infected winter wheat. In affected fields losses were estimated to be between 5 and 10%, generally lower than in 1999 or recent years (1). This may reflect the relatively cool conditions that generally prevailed in June when most spring wheat crops would have been in the critical early growth stages. Unlike 1999, wheat streak mosaic virus (WSMV) was not found at all in oat plants.

Flame Chlorosis (FC) - After a hiatus in 1999, FC was again observed in Manitoba in 2000, albeit only at extremely low levels and only at edges of wheat fields at two sites in the Red River valley south of Winnipeg. However, no FC was found on barley in western Manitoba, where historically it has been most frequently observed and caused the greatest losses (2).

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CROPS / CULTURES: Barley, Oat and Wheat

LOCATION / RÉGION: Manitoba and Saskatchewan

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TITLE / TITRE: CEREAL SMUT SURVEYS, 2000

INTRODUCTION AND METHODS: In July 2000, cereal crops were surveyed for *Ustilago hordei, U. nigra, U. nuda, U. tritici, U. avenae* and *U. kolleri* in Manitoba and Saskatchewan. The area was covered by routes from Winnipeg - Estevan - Moose Jaw - Saskatoon - Prince Albert - Melfort - Yorkton - Russell - Minnedosa - Winnipeg, as well as one day trips around Winnipeg, MB. Fields were selected at random at approximately 10 - 15 km intervals, depending on the frequency of the crops in the area. An estimate of the percentage of infected plants (i.e., plants with sori) was made while walking an ovoid path of approximately 100 m in each field. Levels of smut greater than trace (<0.1%) were estimated by counting plants in a one m^2 area at a minimum two sites on the path.

RESULTS AND COMMENTS: Loose smut (*U. tritici*) was found in 26% of the 143 fields of bread wheats surveyed. In most affected fields, levels of infection were trace; two fields had levels of 0.1%. In durum wheat, loose smut was found in 46% of the 26 fields surveyed. In all infested fields, the level of infection was 0.1%. In awned wheats (likely of the CPS wheat class), loose smut was found in 18% of the 11 fields surveyed. In all these infested fields, the level of infection was 0.1%.

As has been the case for several years, very few oat fields had smut (2 of 18 fields surveyed). Infection levels in all positive fields surveyed were trace. Smutted oat plants were infected with *U. avenae*.

A high incidence of smut (*U. nuda*) was found in barley with 61% of the 87 fields surveyed containing infected plants. Incidence was particularly high in 6-rowed barley (71% of 63 fields) with most fields having levels of trace to 0.1 % smutted plants; however, infection levels of 0.5 to 1% smutted plants per field were observed. In 2-rowed barley, 33% of 24 fields were affected with six fields having trace levels and the other two levels of 0.1 %. False loose smut (*U. nigra*) and covered smut (*U. hordei*) were not found.

CROPS / CULTURES: ***Barley and Wheat***

LOCATION / RÉGION: Central Alberta

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: CEREAL DISEASE SURVEY IN CENTRAL ALBERTA - 2000

METHODS: Cereal crops were randomly selected approximately every 10 km in Alberta Census District (CD) 8 (north central Alberta) on August 2 and 3. This area encompasses Sylvan Lake on the west, Bashaw on the east and is bordered north and south by Ponoka and Innisfail, respectively. Fields were traversed in an inverted V, with analysis of 5 plants taking place at 3 locations. Leaf diseases were scored on a 0-9 scale, with a 4 rating equal to 1% leaf area diseased (PLAD) on the upper leaf canopy, 5-10 PLAD on the middle canopy and 10-25 PLAD on the lower canopy. Common root rot (CRR) was assessed on a 0-4 scale where 1=trace and 4=severe. Other diseases were rated as a percent of the field affected.

RESULTS AND COMMENTS: The results are presented in Table 1. Central Alberta experienced a wetter than normal June and July which delayed crops somewhat and resulted in generally higher disease levels than seen in 1999. Thirty-three barley fields were examined, 22 of which were 2-row and 11 of which were 6-row barley. For the second year in a row, there was an unusually high number of 2-row barley fields encountered. Disease incidence was generally higher in 2-row than 6-row barley. Scald (*Rhynchosporium secalis*) and spot blotch (*Cochliobolus sativus*) severities were higher in 2-row barley fields while net blotch (*Pyrenophora teres*) severity was higher in 6-row fields. The severities of CRR (*C. sativus* and *Fusarium* spp.) were higher in 2000 than in 1999, but disease incidence was similar. Loose smut (*Ustilago nuda*) occurred at trace levels in about 1/3 of the 2-row and 6-row barley fields surveyed. Bacterial blight (*Xanthomonas campestris*) severity and incidence were higher in 2000 than in 1999. Barley leaf stripe (*Pyrenophora graminea*) was not noted in this survey.

Septoria/Stagonospora leaf blotch (*Septoria tritici*, *Stagonospora nodorum*) was present in all 13 wheat fields examined, at relatively high levels. Tan spot (*P. tritici-repentis*) was not noted in 2000. Glume blotch (*S. nodorum*) was present at low levels in four fields. Take-all (*Gaeumannomyces graminis*) was encountered in six fields at mainly low levels, except for one field with about 60% affected plants. Common root rot was found at levels similar to those of 1999. Powdery mildew (*Erysiphe graminis*) was noted in only one field. In a smaller survey conducted later in the season, stripe rust (*Puccinia striiformis*) was found at low levels in two of the four wheat fields examined.

Table 1. Disease severity and incidence in central Alberta cereal fields in 2000.

	AVERAGE DISEASE RATING/NUMBER OF AFFECTED FIELDS[1]							
	Total # Fields	Scald (0-9)	Net (0-9)	Spot (0-9)	CR (0-4)	L Smut (%)	BYD (%)	BB (%)
Barley								
2-row	22	4.9/11	4.4/14	4.2/12	1.2/14	tr/6	tr/1	2.0/2
6-row	11	3.8/4	5.0/5	3.9/9	2.3/3	tr/3	-	2.3/4

	Total # Fields	Septoria/ Stagonospora Leaf Blotch (0-9)	Glume Blotch (%)	BYD (%)	Powdery Mildew (%)	Take-all (%)	CRR (0-4)
Wheat	13	4.7/13	2.3/4	tr/1	3.0/1	10.8/6	0.5/6

[1] Abbreviations: tr=trace amounts (<1%); Net=net blotch; Spot=spot blotch; CRR=common root rot; L Smut=loose smut; BYD=barley yellow dwarf; BB=bacterial blight.

CROP / CULTURE: Corn

LOCATION / RÉGION: Ontario and Quebec

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: SURVEY OF CORN PESTS IN ONTARIO AND QUEBEC IN 2000

INTRODUCTION AND METHODS: In July, September, and October 2000, the Eastern Cereal and Oilseed Research Centre (ECORC) conducted a corn pest survey in Ontario and Quebec. As in previous surveys, the main purpose was to determine the distribution of the bacterial disease Stewart's wilt (*Pantoea stewartii = Erwinia stewartii*) and of viral diseases, such as Maize Dwarf Mosiac (MDM), Sugarcane Mosaic (SCM), Johnson Gross Mosaic (JgM), Maize Chlorotic Dwarf (MCD), Maize Chlorotic Mottle (MCM), Maize White Line Mosaic (MWLM), Wheat Streak Mosaic (WSM), and Barley Yellow Dwarf (BYD). Also recorded were the distribution and severity of other diseases and insects including eyespot (*Aureobasidium zeae*), northern leaf blight (*Exserohilum turcicum*), common rust (*Puccinia sorghi*), common smut (*Ustilago maydis*), head smut (*Sporisorium holci-sorghi = Sphacelotheca reiliana*), stalk rot (*Fusarium spp.*, and *Colletotrichum graminicola*), ear rot (*Fusarium spp.*), European corn borer (*Ostrinia nubilalis*) and corn rootworm (*Diabrotica longicornis* and/or *D. virgifera*). As well, scouting for any new diseases in Canada was conducted, especially for grey leaf spot (*Cercospora zeae-maydis*).

At each of 114 locations visited between July 13 and October 5, the incidence of each pest and the severity of the predominant pest was recorded. At the same time, Stewart's wilt samples and leaves with virus-like symptoms were collected. ELISA tests for Stewart's wilt and viruses were done in the laboratory by using reagent sets, protocols and antibodies provided by AGDIA Inc. (Elkhart, Indiana 46514, USA).

RESULTS AND COMMENTS:

Fungal leaf diseases: Common rust was found at every location (Table 1) and the severity was generally moderate to high according to the resistance level of hybrids and planting date; only a few commercial hybrids exhibited high resistance. Common rust was found as early as June 17at Ottawa. This is one month earlier than usual. Late planted (late June or July) sweet corn and grain corn only had a few rust pustules in both Ontario and Quebec. This difference in severity resulting from planting date, suggests the original infectious uredospores arrived via southerly winds and rainfall due to much more rain in May and June in 2000 than usual.

Northern leaf blight was found at only 9 locations, and only one farm at Forfar in Leeds and Grenville County, ON had indications of potential severe yield loss. The same hybrid had been planted in this 55 acre field for three years and yielded quite well in both 1998 and 1999, but in 2000 the corn plants died before September 4 due to severe infection of northern leaf blight; yield losses were estimated at near 50%. No blight was found at a farm in St-Philippe, Argenteuil County, QC which had severe northern leaf blight in 1998 but less blight in 1999. The producer eliminated the 1998 crop debris by burning and has used a resistant hybrid since 1999.

Eyespot was found at 39 locations but only one hybrid at Elora, Willington County, ON was found to be highly susceptible. In some areas, a form of cross protection between common rust and eyespot appeared to exist, i. e., the more common rust, the less eyespot and vice-versa. One unknown leaf disease was found sporadically at two locations in both Ontario and Quebec. Grey leaf spot was not found at any of the locations surveyed in 2000.

Fungal Ear and Stalk diseases: Stalk and ear rots were observed at all locations where the corn matured. *Fusarium* stalk rot, *Pythium* stalk rot (known as 'early death'), and anthracnose stalk rot were observed. Anthracnose stalk rot was a major problem late in the season in the Chatham-Kent areas. Top-die back, a disease caused by the same pathogen as anthracnose stalk rot was widespread during the period September 12-14. As a result, two weeks later, corn plants dried prematurely due to the spread of anthracnose stalk rot. In north Chatham, 20-100% plant breakage above the ear was evident in early October in every field visited. Resistance to this breakage varied among hybrids from all companies. Because increased lodging was expected, many farmers harvested early.

Common smut was found at 69 locations, but severe damage was not observed on commercial hybrids. Head smut was found at only four locations. In a field at the AAFC Greenbelt Farm, Ottawa-Carleton County, ON the head smut-infected area has increased from 75 x 30 m^2 in 1998 and 300 x 100 m^2 in 1999, to 1850 x 400 m^2 in 2000, but the incidence has decreased from 37% to 19% to 6%, respectively. The area expansion is most likely due to spread during combining, but the reason for decreased incidence is unknown. Cladosporium ear rot (*Cladosporium herbarum*) was identified in one farm sample submitted to ECORC.

Insects: Damage from the European corn borer (ECB) was greater in southern Ontario than eastern Ontario or Quebec. In Chatham-Kent, Elgin, Essex, and Middlesex counties, some fields had incidences as high as 50-80% with 20-50% stalk breakage. The ECB damage increased lodging caused by anthracnose stalk rot. Bt corn showed excellent resistance to ECB, resulting in no increase in lodging from anthracnose stalk rot; there was however no effect on the fungal infection rate.

Lygus lineolaris, which usually sucks the leaves resulting in small white spots , caused severe damage on some AAFC breeding lines at Cobden, Renfrew County, ON. The nymph and adult insect sucked on the young tissues in the whorl and left a wide range of transparent tissues. The leaves dried and sometimes tightened around new whorl leaves impeding further plant growth.

Corn rootworm (CRW) damage was observed at 38 locations, but mostly consisted of leaf damage and silk pruning. Root lodging caused by CRW was found only at Winchester in Stormont Dundas and Glengarry County, ON. Aphids were numerous in some late sweet corn and breeding material in the London and Ottawa areas.

Bacterial diseases: Holcus leaf spot (*Pseudomonas syringae*) symptoms were seen only at one location, and no Goss' bacterial wilt (*Clavibacter michiganensis subsp. nebraskensis = Corynebacterium nebraskense*) was observed. A total of 73 leaf samples with wilt-like symptoms and 11 kernel samples from Stewart's wilt-affected plants were collected from 42 locations in 12 Ontario and 2 Quebec counties. As shown in Table 1, Stewart's wilt was identified with the ELISA test at 40 locations in Chatham-Kent, Elgin, Essex, Frontenac, Huron, Lambton, Leeds and Grenville, Middlesex, Oxford, Peel, Perth, and Waterloo counties, ON, and Les Maskoutains county, PQ.

All 50 of the samples collected with 'typical' Stewart's wilt symptoms consisting of long streaked lesions with wavy margins tested positive for Stewart's wilt. Seven (30.4%) of the other 23 leaf samples were also positive. Of the 11 kernel samples, 5 (45.5%) tested positive for Stewart's wilt. Severe Stewart's wilt damage was found on late planted sweet corn (planted at the end of June) in the area around London, ON. At Northcrest and Ballymate in Middlesex County , ON, 100% of plants were diseased, about 5-25% plants died, and 10-18% plants were barren. Symptoms differed between sweet corn and grain corn. On sweet corn, the symptoms of Stewart's wilt first appeared as long, narrow, white stripes, then changed to brown; plants were dwarfed and some even died.

Viral diseases: Viral symptoms, such as dwarfing, mosaic, and yellowish streaks were observed in late-planted (planted during the last week of June) sweet corn at 5 locations in Middlesex County, ON and late-planted (planted first week of August) grain corn at north Ridgetown, Chatham-Kent County, ON. Other virus-like symptoms, such as deformation and yellowing were observed at 41 locations. Maize Dwarf Mosaic Virus (MDMV, formerly MDMV-A), Sugarcane Mosaic Virus (SCMV, formerly MDMV-B), and Wheat Streak Mosaic Virus (WSMV) were identified in Ontario; no virus was identified in Quebec by ELISA tests. MDMV was identified at 7 locations in Chatham-Kent and Middlesex Counties, SCMV at 7 locations in Chatham-Kent, Middlesex, and Ottawa-Carleton counties, but WSMV only at Ballymate, Middlesex county.

More virus diseases were detected in later-planted plants. In fields with plants subsequently testing positive for virus, 0, 4-12%, and 70% plants with typical viral symptoms were observed in fields planted in late May (Ottawa-Carleton County), in late June (Middlesex County), and in early August (Chatham-Kent County), respectively. For significant MDM and SCM development, high (viruliferous) aphid populations had to coincide with susceptible growth stages. In normal (early) planted corn, sufficient aphid numbers did not occur until the 10-12 leaf stage allowing plants to escape virus infection. In late-planted corn, higher aphid populations coincided with the susceptible stage (prior to the 8-leaf stage) resulting in infection and visible viral symptoms.

Overall in 2000, common rust and anthracnose stalk rot were more severe than average, likely as a result of the generally cool and wet conditions. European corn borer caused more damage in southern Ontario. Stewart's wilt was less common than in 1999. MDMV, SCMV, and WSMV were primarily found on later planted corn.

Acknowledgements

We greatly appreciate the help and scouting of E. Coles, E. Shaham, and S. Thomas, Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada; D. Petri, Direct Seeds; P. Lachance, Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Quebec and J. Montpetit and G. García, Pioneer Hi-Bred International, Inc.

Table 1. The distribution of corn pests in Ontario (ON) and Quebec (QC) in 2000.

COUNTY, PROVINCE	NO. OF LOCATIONS											
	Total	Rust	Blight	Eye spot	Common Smut	Head smut	Stalk rot	Ear rot	Wilt	Virus	ECB	CRW
ONTARIO												
Chatham-Kent	11	11		2	10		13	5	5	2	9	1
Dufferin	1	1		1	1						1	
Durhan	2	2		2	1						2	2
Elgin	2	2			2	1	2	1	1		2	
Essex	2	2	1		2		2	1	2		2	
Frontenac	4	4		2	3				2		4	1
Hastings	1	1		1							1	
Huron	5	5		1	2		1	1	4		5	4
Lambton	1	1					1		1		1	
Lanark	2	2		1	1		1				2	1
Leeds and Grenville	11	11	2	4	7		1	1	4		9	4
Middlesex	15	15	3	4	10		9	1	11	5	8	2
Ottawa-Carleton	6	6	1	4	2	2	1	1		1	3	2
Oxford	3	3	1	2	3		2		3		3	2
Peel	1	1	1	1					1			
Perth	2	2			2		1	1	2		2	2
Prescott and Russell	6	6		1							1	1
Renfrew	6	6		3	3		1				3	1
Stormont Dundas and Glengarry	7	7		5	6		1	1			2	2
Waterloo	2	2		2	2		2	2	2		2	1
Wellington	2	2		2	2		2				2	2
York	1	1									1	1
QUÉBEC												
Argenteuil	1	1									1	
Brome Missisquoi	1	1			1							
La Rivière-Du-Nord	1	1			1			1			1	1
La Vallée-Du-Richelieu	1	1									1	
Lajemmerais	1	1			1							1
Le Haute-Yamaska	1	1										
Les Maskoutains	9	9		1	4	1			2		3	5
Montcalm	1	1			1							1
Vaudreuil-Soulanges	5	5			2						3	1
Total	114	114	9	39	69	4	41	17	40	8	74	38

Rust = common rust, Blight = northern leaf blight, Stalk rot = Anthracnose stalk rot and/or Anthracnose top-die back and/or Fusarium stalk rot, Wilt = Stewart's wilt (ELISA test positive), Virus = Maize dwarf Mosaic Virus (MDMV), and/or Sugarcane Mosiac Virus (SCMV) and/or Wheat Streak Mosaic Virus (WSMV), ELISA test positive. ECB = European corn borer, and CRW = Corn Rootworm.

CROP: Oat

LOCATION: Manitoba and eastern Saskatchewan

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TITLE: CROWN RUST OF OAT IN WESTERN CANADA IN 2000

INTRODUCTION AND METHODS: Surveys for oat crown rust (caused by *Puccinia coronata* Cda f. sp. *avenae* Eriks.) incidence and severity were conducted in southern Manitoba from early July to late August, and in eastern Saskatchewan in mid-August. Crown rust collections were obtained from wild oat (*Avena fatua* L.) and commercially grown oat in farm fields, and from susceptible and resistant oat lines and cultivars grown in uniform rust nurseries. The nurseries were located at Brandon, Emerson, and Morden, MB, and at Indian Head, SK. Virulence phenotypes of single-pustule isolates established from the rust collections were identified, using 16 single-gene backcross lines (*Pc38, Pc39, Pc40, Pc45, Pc46, Pc48, Pc50, Pc51, Pc52, Pc54, Pc56, Pc58, Pc59, Pc62, Pc64, Pc68*) as the primary differential hosts. Single-gene lines with *Pc94* and *Pc96* were included in the differential sets as supplemental differentials.

RESULTS AND COMMENTS: Oat crown rust was less severe in southern Manitoba and more severe and widespread in south-eastern Saskatchewan in 2000 than in previous years. Traces of crown rust infection were first observed on wild oat (*Avena fatua* L.) near Emerson, MB, on July 9. Subsequent conditions were cool with above average rainfall. This limited the development of the rust during most of the growing season. By mid-August, crown rust severities ranging from trace to moderate levels (up to 70%) were found on wild oat, and trace to 20% crown rust severities were observed in late seeded commercial oat fields in southern Manitoba. Early seeded fields of susceptible cultivars (e.g., Robert and Riel) escaped damage. Crown rust infections remained at trace levels in field plots of the cultivar AC Assiniboia, and ranged from light to 20% in field plots of Triple Crown. At various locations across eastern Saskatchewan from Estevan to Assiniboia, crown rust severities ranging from 20% to 80% were commonly found on wild oat, and severities ranging from 5% to 40% were found in late seeded commercial oat fields. This was the most severe and widespread occurrence of crown rust in south-eastern Saskatchewan for many years.

To date, 210 single-pustule isolates of *P. coronata* f. sp. *avenae* established from the collections obtained in Manitoba and Saskatchewan in 2000 have been evaluated for their virulence phenotypes using the 18 differential hosts. As in recent years, the prairie rust population in 2000 was predominated by isolates with virulence to genes *Pc38* and *Pc39*; cultivars such as Dumont, Robert, Riel, Belmont, AC Marie and AC Preakness, would have been susceptible to these isolates. Six isolates had virulence to AC Assiniboia and AC Medallion. Thirty-three isolates had virulence to the single-gene line with *Pc48*, a gene found in Triple Crown. One isolate was found to have virulence to lines with the four resistance genes, *Pc38, Pc39, Pc48*, and *Pc68*, combined. This isolate also was virulent to *Pc96*. None of the 210 isolates were virulent to *Pc94*. Genes *Pc48, Pc68, Pc94* and *Pc96* are being used in the oat breeding program at the Cereal Research Centre to develop new cultivars possessing various combinations of these genes for protection against the prairie rust population.

CROP / CULTURE: Wheat

LOCATION / RÉGION: Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE /TITRE: ERGOT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2000

INTRODUCTION AND METHODS: Wheat entries in regional variety trials (Saskatchewan Advisory Council on Grain Crops tests) at 22 locations in Saskatchewan were examined for the presence of ergot (*Claviceps purpurea*) in harvested grain. The 22 locations were distributed among four crop production areas (CPA) of Saskatchewan (Saskatchewan Agriculture and Food, 2001). The entries, 18 Canada Western Red Spring (CWRS), 9 Canada Prairie Spring (CPS), 6 Canada Western Extra Strong (CWES) and 5 Canada Western Amber Durum (CWAD), consisted of registered cultivars and advanced co-op lines. Trials were planted at the following locations: 5 in CPA 1 (Assiniboia, Beverley, Fox Valley, Stewart Valley and Swift Current), 9 in CPA 2 (Carlyle, Elrose, Girvin, Saskatoon, Luseland, Outlook, Regina, Scott and Weyburn), 8 in CPA 3 (Battleford, Indian Head, Jedburgh, Kelvington, Lashburn, Melfort, Rosthern and Wynyard) and 3 in CPA 4 (Loon Lake, Nipawin and Shellbrook). For each entry and location, a composite sample of about 300 g from all replicates was analyzed for the presence of ergot bodies. Percent ergot was calculated as (weight of ergot bodies/total weight of samples) X100.

RESULTS AND COMMENTS: Locations where ergot was detected in common and durum wheat are listed in Table 1. The percentage of locations where ergot was present at more than trace levels was 40% for CPA 1, 78% for CPA 2, 75% for CPA 3 and 100% for CPA 4. Girvin, Weyburn and Shellbrook had the highest percent ergot. Overall, ergot levels across the province were somewhat lower than in 1999 (Fernandez et al., 2000). Locations where one or more entries would have been downgraded because of high ergot levels (Canadian Grain Commission, 1991) were Swift Current in CPA 1, Girvin, Outlook and Weyburn in CPA 2, Jedburgh, Kelvington, Lashburn and Melfort in CPA 3, and all locations in CPA 4. In 1999, all locations with ergot had high enough disease levels to cause downgrading in at least one entry. Only seven of these locations were common to 1999 and 2000. Average percent ergot was higher in the CWAD and CWES than in the CWRS or CPS classes.

Average percent ergot of the entries varied from 0.01 to 0.08% (Table 2). As in 1999, the variability among locations precluded any conclusion regarding differences in susceptibility to ergot among entries, although none appeared to be more susceptible than the rest.

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Canadian Grain Commission, 1991. Official Grain Grading Guide. 189 pp.

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Saskatchewan Agriculture and Food, 2001. Varieties of Grain Crops 2001. 24 pp.

Table 1. Mean percentage of ergot bodies in Canada Western Red Spring, Canada Prairie Spring, Canada Western Amber Durum and Canada Western Extra Strong wheat cultivars planted in regional variety trials in Saskatchewan in 2000.

Crop Production Area	Location	PERCENT ERGOT[1]				
		Canada Western Red Spring	Canada Prairie Spring	Canada Western Extra Strong	Canada Western Amber Durum	Mean
1	Assiniboia	0.01	0.01	0.02	0.03	0.02
1	Swift Current	0.03	0.01	0.00	0.01	0.02
2	Carlyle	0.00	0.00	0.01	0.01	0.01
2	Elrose	0.01	0.00	0.01	0.01	0.01
2	Girvin	0.04	0.04	0.06	0.06	0.05
2	Saskatoon	0.01	0.00	0.00	0.02	0.01
2	Outlook	0.02	0.04	0.08	0.08	0.04
2	Regina	0.00	0.01	0.01	0.01	0.01
2	Weyburn	0.03	0.04	0.11	0.12	0.06
3	Indian Head	0.04	0.03	0.01	0.00	0.01
3	Jedburgh	0.01	0.02	0.03	0.07	0.02
3	Kelvington	0.04	0.04	0.06	na	0.04
3	Lashburn	0.01	0.02	0.04	0.08	0.03
3	Melfort	0.01	0.00	0.03	0.04	0.02
3	Wynyard	0.00	0.01	0.02	0.03	0.01
4	Loon Lake	0.02	0.06	0.11	na	0.04
4	Nipawin	0.01	0.02	0.04	na	0.02
4	Shellbrook	0.04	0.04	0.14	na	0.06
	Mean	0.02	0.02	0.04	0.04	0.03

[1] percent ergot by weight.

Table 2. Mean percentage of ergot bodies in entries planted in regional variety trials in Saskatchewan in 2000.

CULTIVAR	NO. OF TRIAL LOCATIONS	PERCENT ERGOT	
Canada Western Red Spring		by weight	S.D.
AC Abbey	18	0.01	0.01
AC Barrie	18	0.02	0.03
AC Intrepid	18	0.02	0.02
AC Splendor	18	0.01	0.01
Alikat	18	0.01	0.02
CDC Bounty	28	0.02	0.03
Mackenzie	18	0.02	0.03
Prodigy	18	0.01	0.01
5500HR	18	0.03	0.02
5600HR	18	0.02	0.03
BW243	18	0.01	0.01
BW252	18	0.01	0.01
BW256	18	0.05	0.06
BW259	18	0.02	0.04
BW263	18	0.01	0.02
BW264	18	0.02	0.02
BW754	18	0.01	0.02
BW755	18	0.01	0.01
Canada Prairie Spring			
AC Barrie	18	0.03	0.05
AC Crystal	18	0.01	0.01
AC Karma	18	0.02	0.03
AC Vista	18	0.02	0.01
AC 2000	18	0.02	0.02
5700PR	18	0.01	0.01
HY639	18	0.02	0.03
HY644	18	0.04	0.04
HY962	18	0.02	0.02
Canada Western Extra Strong			
AC Barrie	18	0.02	0.03
Glenlea	18	0.05	0.05
Amazon	18	0.06	0.09
AC Corrine	18	0.06	0.05
AC Glenavon	18	0.05	0.04
ES21	18	0.02	0.03
Canada Western Amber			
AC Morse	14	0.04	0.04
AC Navigator	14	0.08	0.07
AC Pathfinder	14	0.04	0.03
Kyle	14	0.03	0.03
DT494	14	0.03	0.04

CROP / CULTURE: Wheat

LOCATION / RÉGION: Saskatchewan

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TITLE/ TITRE: FUSARIUM HEAD BLIGHT IN COMMON AND DURUM WHEAT IN SASKATCHEWAN IN 2000

INTRODUCTION AND METHODS: The incidence and severity of fusarium head blight (FHB) were assessed in 152 common wheat (Canada Western Red Spring and Canada Prairie Spring) and 61 durum wheat (Canada Western Amber Durum) fields from 20 crop districts (CDs) in Saskatchewan. Heads from 50 plants, between milk and dough stages, were collected randomly from each field and sent to the Crop Protection Laboratory in Regina for disease assessment, pathogen isolation and identification. An FHB index (percent number of heads affected x mean severity of infection/100) was determined for each field. An average FHB index for affected fields in each CD, and for CDs grouped by soil zone (Zone I=Brown, Zone II=Dark Brown and Zone III=Black/Grey soils) was calculated. Kernels from heads with symptoms were surface sterilized in 10% Javex solution for 1 minute and plated on potato dextrose agar for identification of *Fusarium* spp.

RESULTS AND COMMENTS: FHB was found in a total of 60% of the common and durum wheat fields surveyed in Saskatchewan, slightly more than in the two previous years (54-55%) (Table 1; Fernandez et al., 1999;2000). Mean FHB indexes were also higher in 2000 (1.7% in common, 1.2% in durum wheat) than in 1999 (1.1% in common, 0.5% in durum wheat) but lower than in 1998 (3.0% in common, 2.3% in durum wheat). The percentage of infected fields and FHB index were the lowest in Zone I. The highest mean FHB index was found in CDs 1A (south-east), 5A (east-central) and 8B (north-east). Individual durum wheat fields with the highest FHB index (2.2 to 5.8%) were in CDs 1A, 5A and 6A (central). Individual common wheat fields with the highest FHB index (2.0 to 12%) were in CDs 1A, 1B (south-east), 2A, 2B (south-east), 5A, 5B (east-central), 6B (central), 8B (north-east) and 9A and 9B (north-west).

The most commonly isolated *Fusarium* sp. was *F. sporotrichioides*, followed by *F. poae* and *F. avenaceum* (Table 2). The latter two species were more frequent in Zone III than in the other two zones. *Fusarium culmorum* and *F. graminearum* were present in only a few fields. Most of the fields where *F. graminearum* was found were in CD 1A. *Fusarium sporotrichioides* was more prevalent in 2000 (75% of fields) than in 1999 (33%). *Fusarium equiseti*, a common soil saprophyte, but rarely isolated from kernels in the past, was isolated at a frequency of 23% in 2000.

We gratefully acknowledge the participation of Saskatchewan Agriculture and Food extension agrologists in the survey, and financial support by the Agriculture Development Fund.

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Table 1. Incidence of fusarium head blight and disease severity (FHB index) in common and durum wheat in Saskatchewan in 2000.

SOIL ZONE	CROP DISTRICT	COMMON WHEAT		DURUM WHEAT	
		No. fields affected/total fields	FHB[1] Index	No. fields affected/total fields	FHB Index
Zone I	3A-N	0 /1	-	-	-
	3A-S	0 /4	-	2 /5	0.2
	3B-N	2 /4	0.6	3 /8	0.8
	3B-S	1 /3	0.2	2 /2	0.1
	4A	0 /1	-	0 /2	-
	4B	0 /4	-	0 /3	-
	7A	0 /4	-	3 /6	0.5
Total or mean:		3 /21	0.5	10 /26	0.5
Zone II	1A	10 /10	3.3	6 /6	4.1
	2A	5 /5	1.8	0 /1	-
	2B	2 /8	1.6	4 /8	0.2
	6A	9 /11	0.3	5 /7	1.1
	6B	6 /10	1.6	5 /5	0.3
	7B	0 /8	-	1 /2	0.1
Total or mean:		32 /52	1.8	21 /29	1.5
Zone III	1B	7 /7	1.6	-	-
	5A	5 /6	2.4	1 /1	2.2
	5B	11 /13	1.5	0 /3	-
	8A	4 /12	0.2	1 /1	0.2
	8B	8 /11	3.4	1 /1	0.2
	9A	8 /12	0.9	-	-
	9B	16 /18	1.9	-	-
Total or mean:		59 /79	1.8	3 /6	0.9
Overall total or mean:		94 /152	1.7	34 /61	1.2

[1] FHB index calculated as (percent number of heads affected x mean severity of infection)/100.

Table 2. Number of fields where *Fusarium* spp. were isolated from common and durum wheat in Saskatchewan in 2000.

Soil zone/crop districts	**No. affected fields**	***FUSARIUM* SPP.**					
		avena-ceum	***culmorum***	***equiseti***	***gramin-earum***	***poae***	***sporotrich-ioides***
Zone I							
3A-S	2	0	0	0	0	1	1
3B-N	5	3	0	3	0	0	3
3B-S	3	1	0	0	0	1	3
7A	3	1	0	1	0	1	2
Total	13	5	0	4	0	3	9
% fields		38	0	31	0	23	69
Zone II							
1A	16	5	3	4	12	4	11
2A	5	1	0	0	3	0	3
2B	6	1	0	1	0	4	5
6A	14	5	0	1	0	7	12
6B	11	5	0	3	1	3	8
7B	1	1	1	0	0	0	1
Total	53	18	4	9	16	18	40
% fields		34	8	17	30	34	75
Zone III							
1B	7	3	0	1	4	4	6
5A	6	4	0	1	2	4	3
5B	11	5	1	2	0	5	9
8A	5	1	0	0	1	4	4
8B	9	7	0	3	0	3	7
9A	8	3	0	1	1	4	6
9B	16	9	0	8	0	7	13
Total	62	32	1	16	8	31	48
% fields		52	2	26	13	50	77
Overall total	128	55	5	29	24	52	97
Overall % fields		43	4	23	19	41	76

CROP / CULTURE: Durum wheat

LOCATION / RÉGION: Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: LEAF DISEASES OF DURUM WHEAT IN SASKATCHEWAN IN 2000

INTRODUCTION AND METHODS: A survey for leaf diseases of durum wheat was conducted between the milk and dough growth stages in 16 crop districts (CD) in Saskatchewan. In each of 56 fields, 10 flag and 10 penultimate leaves were collected at random and air dried at room temperature. Percent leaf area affected by leaf spots was recorded for each leaf. An average percent infection level (severity) was calculated for each field and CD. Surface disinfested leaf pieces were plated on water agar for identification and quantification of leaf spotting pathogens.

RESULTS AND COMMENTS: Leaf spots were observed on the flag or penultimate leaves of all durum wheat fields surveyed. In most cases, the penultimate leaves were senescent and percent infection could not be assessed. Leaf spot severities in individual fields ranged from 1% to 59% of the flag leaf infected. The highest leaf spot severities (over 20%) were in CDs 1A, 2A, 2B (south-east), 3AS (south-central) and 3BN (south-west) (Table 1).

The most prevalent leaf spotting pathogen was *Pyrenophora tritici-repentis* (tan spot), both in the number of fields where it was present (near 100%) and in the percent leaf area colonized (Table 1). This was followed by *Cochliobolus sativus* (spot blotch) which was most commonly isolated in the southeast (CD 1A). *Septoria tritici* and *S. avenae* f. sp. *triticea* (septoria leaf blotch complex) were more common and widely distributed compared to the past two years (Fernandez et al., 1999; 2000). *Stagonospora nodorum* was isolated at lower levels than in 1999. *Pyrenophora teres* was isolated from leaves of durum wheat in a few fields throughout the province (data not presented).

We gratefully acknowledge the participation of Saskatchewan Agriculture and Food extension agrologists in this survey, and financial support from the Agriculture Development Fund.

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(http://res2.agr.ca/london/pmrc/english/report/Disease99.html)

Table 1. Distribution and severity of leaf spotting diseases, and estimate of the percentage of flag leaf area colonized by leaf spotting fungi, in durum wheat fields in Saskatchewan in 2000.

Crop District	**No. fields surveyed**	**Mean severity**[1]	**LEAF SPOT PATHOGENS**				
			P. tritici-repentis	***S. nodorum***	***S. tritici***	***S. avenae f.sp. triticea***	***C. sativus***
1A	6	36	69 /6[2]	3 /1	12 /1	2 /1	28 /6
2A	1	22	92 /1	1	-	-	8 /1
2B	8	16	95 /7	1	-	11 /1	6 /4
3A-S	5	15	96 /5	-	-	5 /1	5 /3
3B-N	8	10	91 /8	5 /2	16 /2	6 /2	2 /2
3B-S	2	8	100 /2	-	1 /1	-	-
4A	2	2	96 /2	-	-	-	-
4B	3	1	74 /3	22 /1	56 /1	-	-
5A	1	8	72 /1	11 /1	-	-	17 /1
5B	3	7	91 /3	2 /1	24 /1	-	-
6A	4	47	94 /4	4 /2	8 /1	8 /1	-
6B	4	9	92 /2	-	8 /1	18 /1	1 /1
7A	6	4	94 /6	16 /1	-	4 /1	3 /1
7B	1	2	33 /1	4 /1	8 /1	-	22 /1
8A	1	1	67 /1	-	8 /1	8 /1	15 /1
8B	1	10	99 /1	-	-	-	15 /1
Meant/total	56	12	88/56	7/10	16/10	8/9	13/23

[1] percent flag leaf area infected.

[2] percent leaf area colonized by fungus / number of fields where it occurred.

CROP / CULTURE: Wheat

LOCATION / RÉGION: Manitoba and eastern Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: STRIPE RUST OF WHEAT IN MANITOBA AND SASKATCHEWAN IN 2000

INTRODUCTION AND METHODS: During annual surveys of wheat fields for incidence and severity of stem rust *(Puccinia graminis* Pers. f. sp. *tritici* Eriks. & E. Henn.) and leaf rust (*Puccinia triticina* Eriks.) conducted in July, August, and September 2000, stripe rust (*P.striiformis* Westend. f. sp. *tritici*), which is very uncommon in Manitoba and Saskatchewan, was found in many wheat fields over a wide geographic area from eastern Manitoba to eastern Saskatchewan. Leaves infected with stripe rust were collected to determine pathotypic specialization on appropriate sets of host differential lines.

RESULTS AND COMMENTS: Cool conditions and high humidity in Manitoba during June and July were favorable for stripe rust infection. Stripe rust severity in affected wheat fields was mostly at trace levels. However, in one field of McKenzie wheat, severity was estimated at 5%. Genetic resistance to stripe rust infection is variable among wheat cultivars recommended for Manitoba and Saskatchewan. In 2000 a significant percentage of cereal fields in eastern Manitoba were sprayed with fungicide for the control of foliar and head diseases, and these fungicides also will control the rust pathogens. Late-planted fields had little or no infection due to higher daily temperatures that inhibit stripe rust infection.

Stripe rust is a disease that is favored by low (10°C) temperatures and is usually found in the Pacific Northwestern region of North America on spring-sown crops. Yield losses exceeding 70% in susceptible wheat cultivars due to stripe rust infection have been reported in the Pacific Northwest (Line and Qayoum, 1991). Stripe rust overwinters in northwestern and southern USA. In the winter of 1999-2000, unusually high amounts of stripe rust were found in the southern and southeastern USA and the rust progressed northward during the spring and summer (Hughes, 2000). Due to unusually cool environmental conditions and higher than average amounts of inoculum coming into the region, stripe rust was commonly found in wheat fields and experimental plots in the Upper Midwestern region of the USA and in southeastern Manitoba. Higher temperatures in late July and early August reduced or eliminated further spread and infection of stripe rust. In past years, under more normal environmental conditions, stripe rust was not a threat to wheat production in Manitoba and Saskatchewan. If stripe rust becomes a serious perennial problem in this region it will be important to determine the relative susceptibility of the currently registered wheat cultivars and emphasize stripe rust resistance in future cultivars.

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(http://www.crl.umn.edu/crb/2000crb/00CRBfin.html)

Line, R. F. and Qayoum, A. 1991. USDA Tech. Bull. 1788.

CROP / CULTURE: Wheat

LOCATION / RÉGION: Manitoba and eastern Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: 2000 FUSARIUM HEAD BLIGHT SURVEY OF SPRING WHEAT IN MANITOBA AND EASTERN SASKATCHEWAN

INTRODUCTION AND METHODS: Spring wheat fields were surveyed for fusarium head blight (FHB) in southern Manitoba and south-eastern Saskatchewan between 24 July and 3 August 2000. The incidence and severity of FHB in 126 fields were assessed by sampling 50 to 100 wheat heads at three locations in each field between watery-ripe and medium dough stages of development (average Zadoks growth stage 79.8). Up tp 30 kernels per field from sampled heads were surface-sterilized and incubated on potato dextrose agar under continuous cool white light for 4-5 days to identify the *Fusarium* species present . When more than one *Fusarium* species were present, single spores were grown on carnation leaf agar or synthetic nutrient agar to facilitate identification. The FHB index was calculated as follows: Average incidence X Average severity/100.

RESULTS AND COMMENTS: The disease was present in 96 % of fields. The average FHB index was 7.9%, but the disease was not uniform across the region. The most severely affected areas were the Red River Valley north and south of Winnipeg, and further west as far as Portage between Hwys 1 and 2 where the average index was 10.8%. Many fields had an FHB index of 20-30% and in one field it was as high as 47%. Western Manitoba, including fields near Hwy 3, close to the US border, from Manitou to Melita, and south-eastern Saskatchewan, had low levels of the disease, averaging an FHB Index of 3.5% with a range from 0.1 to 29%. This was in contrast to 1999 when the most severe levels of FHB were found in the Russell area close to the Saskatchewan border. The predominant pathogen was *Fusarium graminearum*, comprising over 96% of the isolations (Table 1). Other species found included *F. sporotrichioides, F. equiseti, F.avenaceum,* and *F. culmorum.* Yield and quality/grade losses were relatively high in central Manitoba in 2000. The majority of fields surveyed were of common wheat. Provincial reports indicate durum wheat fields in south-western Manitoba also were severely affected by FHB. These fields may have been at too early a growth stage to be selected in the survey and, therefore, the subsequent severity of the problem was not recognized.

Table 1. Percent *Fusarium* species isolated from spring wheat in southern Manitoba in 2000.

FUSARIUM SPP.	PERCENT ISOLATED
F. graminearum	96.6
F. sporotrichioides	0.6
F. equiseti	0.1
F. avenaceum	0.6
F. culmorum	0.3
Unknown	1

CROP / CULTURE: Wheat

LOCATION / RÉGION: Manitoba and eastern Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: SURVEY OF LEAF SPOT DISEASES OF WHEAT IN MANITOBA - 2000

INTRODUCTION AND METHODS: Spring wheat fields were surveyed for leaf spot diseases in southern Manitoba and south-eastern Saskatchewan between July 24 and August 3, 2000. Leaves were collected from 137 spring wheat fields (mostly common wheat) between watery-ripe and soft dough stages of development. Severity of disease on upper and lower leaves was categorized as 0, trace, 1, 2, 3 or 4, with 4 describing dead leaves and 1 lightly affected. Samples of diseased leaf tissue were surface-sterilized and placed in moisture chambers for 5-7 days to promote pathogen sporulation for disease identification.

RESULTS AND COMMENTS: Higher than average rainfall in July and August favoured development of leaf spot diseases, which were moderate to severe in southern Manitoba. Foliar fungicides were widely used in 2000 and disease on the upper leaves was either moderately severe, rating 2.5 to 4, or light, rating trace to 1. Lower leaves were mostly senesced at the time the fields were surveyed. Septoria tritici blotch, caused by *Mycosphaerella graminicola*, occurred in 93 % of fields and accounted for 48.7 % of isolations of pathogenic fungi from foliar lesions (Table 1). Prevalence and severity of tan spot, caused by *Pyrenophora tritici-repentis* was higher than in 1999. The pathogen was found in 74% of fields, and comprised 20.3 % of fungal isolations. Spot blotch, caused by *Cochliobolus sativus* had the third highest prevalence and severity. It was isolated from 71% of fields and accounted for 15.1% of isolations. As in past years *Septoria avenae* was the least commonly isolated leaf spot pathogen, but was found at higher levels than in previous years. Stagonospora nodorum blotch, caused by *Phaeosphaeria nodorum* was found in 25% of fields and comprised 8.3 % of isolations; therefore both prevalence and severity were lower than in 1999. Other pathogenic fungi isolated from the leaf tissue included *Platyspora pentamera,* cause of Platyspora leafspot, *Fusarium equiseti, F. graminearum* and *F. sporotrichioides*. These were all found at low levels and comprised less than 4% of the total isolations.

Table 1. Prevalence and isolation frequency of leaf spot pathogens in 137 fields of common wheat in Manitoba and south-eastern Saskatchewan in 2000.

	DISEASE				
	***Septoria* spp. (Septoria blotches)**			***Cochliobolus sativus***	***Pyrenophora tritici-repentis***
	S. nodorum	***S. tritici***	***S. avenae***	**Spot blotch**	**Tan spot**
Prevalence (% fields)	70	93	25	71	74
Isolations (%)	8.3	48.7	3.7	15.1	20.3

CROP / CULTURE: Wheat

LOCATION / RÉGION: Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: LEAF DISEASES OF COMMON WHEAT IN SASKATCHEWAN IN 2000

INTRODUCTION AND METHODS: A survey for leaf diseases of common wheat was conducted in fields randomly selected from each crop district (CD) in Saskatchewan. Ten flag and ten penultimate leaves were collected at random from 134 common wheat (CWRS, CPS and CWES classes) fields at the late-milk to dough stages of development. The percent leaf areas covered by leaf spots and leaf rust were recorded for each leaf, and an average percent severity calculated for each CD. Identification and quantification of leaf spotting pathogens was done by plating surface-sterilized leaf pieces on water agar from leaves selected from most field samples and estimating the relative prevalence of each pathogen identified for each leaf examined. An average percent prevalence was then calculated for each CD.

RESULTS AND COMMENTS: Leaf spot diseases were found in all fields surveyed (Table 1). Although infection levels of flag leaves for individual fields ranged from 'trace' (1-5 % severity) to 'severe' (>50 % severity), severity in most fields was slight to moderate. Average leaf spot severity on the flag leaves tended to be highest in the north-eastern and central regions of the province (CDs 2B, 5B, 6B, 8A, 8B). This pattern was similar to that in 1999, although leaf spot severities were lower in 2000. Leaf rust occurred mainly in the south-eastern and east-central regions of the province (CDs 1A, 1B, 2A, 2B and 5A) and at trace to slight levels, a severity considerably lower than in 1999.

As in 1999, the most prevalent leaf spot disease was tan spot (*Pyrenophora tritici-repentis*), both in the number of fields where it was present and its relative frequency on infected leaves (Table 2). This was followed by the septoria leaf spot complex (*Septoria tritici*, *Stagonospora nodorum* and *S. avenae* f. sp. *triticea*). While *S. nodorum* occurred through the province, it was most common in the central and northern regions of the province. *S. tritici* likewise occurred throughout the province, but was more prevalent than *S. nodorum*. This distribution of the septoria leaf spot pathogens was the reverse of that found in 1999 and likely resulted from cool weather conditions in the summer of 2000, which favoured *S. tritici*. Spot blotch (*Cochliobolus sativus)* also occurred throughout the province, but at relatively low levels.

We gratefully acknowledge the participation of Saskatchewan Agriculture and Food extension agrologists in this survey, and financial support from the Saskatchewan Agriculture Development Fund.

Table 1. Distribution and severity of leaf spot diseases and leaf rust in common wheat in Saskatchewan fields surveyed at the late milk to dough stages in 2000.

Crop District	LEAF SPOTS		LEAF RUST	
	No. fields affected/ surveyed	Severity [1] (%)	No. fields affected/ surveyed	Severity (%)
1A	5 /5	12	5 /5	28
1B	7 /7	7	5 /7	12
2A	5 /5	7	3 /5	2
2B	10 /10	18	1 /10	Trace
3A-N	1 /1	8	1 /1	Trace
3A-S	4 /4	8	1 /4	Trace
3B-N	4 /4	5	0 /4	
3B-S	3 /3	2	0 /3	
4A	1 /1	2	0 /1	
5A	6 /6	9	2 /6	Trace
5B	9 /9	21	0 /9	
6A	7 /7	13	0 /7	
6B	9 /9	38	0 /9	
7A	5 /5	3	0 /5	
7B	8 /8	2	0 /8	
8A	15 /15	21	0 /15	
8B	4 /4	46	0 /4	
9A	9 /9	16	0 /9	
9B	18 /18	15	0 /18	
Total	134 /134		18 /134	
Mean		13		

[1] Percent flag leaf area infected.

Table 2. Estimated relative frequency of leaf spot fungi in the upper leaf canopy of common wheat in Saskatchewan fields surveyed in 2000.

Crop District	No. of fields	LEAF SPOT FUNGI[1]				
		P. tritici-repentis	*S. nodorum*	*S. tritici*	*S. avenae f.sp. triticea*	*C. sativus*
1A	2	79 /2	9 /1		4 /1	9 /1
1B	7	31 /7	9 /4	8 /4	20 /5	32 /7
2A	5	57 /4	4 /2	13 /3	11 /2	15 /5
2B	10	83 /10	1 /2	3 /3	3 /3	6 /8
3A-S	4	79 /4	1 /1	18 /3		2 /2
3B-N	4	38 /4		60 /4	1 /1	
3B-S	3	74 /3	12 /2	14 /3		
4A	1	100 /1				
4B	4	85 /4	1 /1	9 /2		2 /1
5A	6	39 /6	14 /3	26 /6	9 /1	10 /5
5B	8	36 /8	21 /8	40 /8	1 /2	2 /5
6A	5	48 /5	10 /5	42 /5		
6B	8	35 /8	18 /8	38 /8	3 /1	6 /5
7A	5	60 /5	18 /4	22 /5		1 /1
7B	8	28 /7	26 /7	39 /7	6 /3	1 /1
8A	15	42 /14	22 /14	31 /15	1 /1	4 /8
8B	1	1 /1	20 /1	49 /1		
9A	9	20 /9	25 /9	54 /9		2 /6
9B	18	24 /12	25 /18	49 /18		3 /8
Mean frequency		50	13	27	3	5
Total	123	104	80	94	20	63

[1] Percent relative frequency of pathogen/number of fields where it occurred.

CROP / CULTURE: Wheat

LOCATION / RÉGION: Manitoba and eastern Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: LEAF RUST OF WHEAT IN WESTERN CANADA IN 2000

INTRODUCTION AND METHODS: Nurseries and commercial fields of wheat in Manitoba and eastern Saskatchewan were surveyed for the incidence and severity of leaf rust (*Puccinia triticina* Eriks.) during July and August 2000. Infected leaf samples were collected for pathotype identification by inoculating spores collected from these leaves onto a set of 16 single gene differential host lines.

RESULTS AND COMMENTS: Wheat leaf rust was widespread but relatively light throughout Manitoba and eastern Saskatchewan during the 2000 crop season. Leaf rust infections were first noticed in Manitoba on June 14 but cool wet weather slowed the spread and development of the disease during late June and early July. In many parts of Manitoba seeding was done earlier than usual, in late April and early May, so much of the wheat crop was reaching maturity in late July and early August. These early seeded fields avoided intense leaf rust pressure because they were mature before the disease developed extensively. Increased use of foliar fungicides in 2000 also decreased the incidence of leaf rust from that in previous years. In surveys done during the last week of July and the first week of August leaf rust was found in most fields, but cultivars such as AC Cora and McKenzie continued to show high levels of resistance. Yield losses were not significant in most fields but late seeded fields of susceptible cultivars may have suffered yield losses in the 5-10% range.

The predominant pathotypes of *P. triticina* isolated from Manitoba and Saskatchewan were MBDS, TGBJ, and THBJ, similar to 1999. Evaluation of isolates from other parts of Canada is in progress.

CROP / CULTURE: Winter wheat

LOCATION / RÉGION: Saskatchewan

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TITLE/ TITRE: FUNGI ISOLATED FROM CROWNS OF WINTER WHEAT IN SASKATCHEWAN, 1987.

INTRODUCTION AND METHODS: (Note that this report presents data from 1987 not published previously. It is of interest and potential relevance because of the current focus on *Fusarium* fungi, particularly the mix of species occurring in the prairie provinces prior to the contemporary epidemic of fusarium head blight in Manitoba and parts of Saskatchewan - Ed.)

In July, 1987, 40 plants (cv. Norstar) were collected from each of 49 winter wheat fields throughout Saskatchewan. A diamond-shaped sampling pattern was used, with each side being approximately 40 m in length. Leaves and roots were removed from crowns. Crowns were rinsed under running water for 1 hour then surface sterilized (15 sec. 100% ethanol, 45 sec. 10% commercial bleach, and 2 x1 minute sterile distilled water rinses). Subsequently, one tiller was plated on minimal medium to determine the spectrum of fungi present, and a second tiller was plated on Nash Snyder medium (2). After 10 days of incubation at room temperature, putative *Fusarium* colonies were transferred to potato dextrose agar in 9 cm diameter petri plates and grown for 10 days at room temperature. Plugs from non-sporulating cultures were transferred to carnation leaf agar medium (1) and grown under ultraviolet light at 20 C for 2 weeks. The original non-sporulating cultures were 'slashed' to stimulate sporulation (in the case of *Fusarium avenaceum*). Sporulating colonies were identified to species according to spore morphology and colony morphology, pigmentation and rate of growth (fast growing isolates grew to the edge of the plate within 10 days).

RESULTS AND COMMENTS: The most frequent fungi present on crowns plated on minimal medium were *Fusarium spp. Bipolaris sorokiniana* and the opportunistic fungi *Penicillium* spp. and *Alternaria spp.* were also found in low frequencies. *Fusarium acuminatum* was present in crowns at all sites sampled. *Fusarium culmorum, F. poae, F. oxysporum* and *F. equiseti* were isolated from 29, 10, 14 and 92 % of the fields, with equal distribution across the province. *Fusarium avenaceum* was present in 37% of the fields, with the majority of these being in the northern part of the province in the gray-black soil zone.

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CROP / CULTURE: Wheat

LOCATION / RÉGION: Ontario

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TITLE / TITRE: FUSARIUM HEAD BLIGHT SURVEY OF WINTER WHEAT IN 2000 IN ONTARIO

INTRODUCTION AND METHODS: Winter wheat fields were randomly selected at harvest on farms across southern Ontario. Mature wheat spikes were harvested using hand shears from 10 areas of approximately $2m^2$ close to the center of each field. The spikes were threshed with an Almaco stationary plot thresher (model VPT-OSC). Deoxynivalenol (DON) was extracted from a 20-g subsample in 100 mL of methanol and water (1:9), and quantified with the commercial preparation EZ-Quant DON Plate Kit (Beacon Analytical Systems, Inc., Scarborough, ME). The limit of detection was 0.2 ppm. Sixty kernels per field were surface-sterilized in 0.16% NaOCl (diluted commercial bleach) for three minutes, air dried and placed on acidifed potato dextrose agar. The agar plates were incubated for seven days under a 12:12 hr light/dark cycle, at room temperature. *Fusarium* colonies were subsequently transferred to carnation-leaf agar, and incubated as above. Species identification was based on Nelson et al. (1983) and Burgess et al. (1988).

RESULTS AND COMMENTS: The highest percentage of *F. graminearum*, and DON content (ppm) were observed in Grey county (averaging 18.9 %, and 3.4 ppm), followed by Lambton, Middlesex, Essex, and Kent counties (Table 1). Fusarium head blight was present in 91 % of the fields examined. *Fusarium graminearum* was the predominant species followed by *F. poae, F. sporotrichioides, F. subglutinans*. Based on these results, fusarium head blight caused significant losses in Ontario in 2000. By contrast, in 1999 only trace levels of *F. graminearum* and DON were detected (data not shown).

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Table 1. DON content (ppm) and percent *Fusarium* species isolated from winter wheat in 2000 in Ontario.

County	No. of fields examined	DON (ppm)	PERCENT *FUSARIUM* SPECIES ISOLATED				
			F. gram. (%)	*F. poae* (%)	*F. spor.* (%)	*F. subg.* (%)	*Fusarium* spp. (%)
Essex	9	0.5	3.9	0.4	0.4	0	0.2
Kent	2	1.5	1.7	0.9	0.9	0.9	0
Lambton	14	1.6	6.5	0.6	0.2	0.1	0
Middlesex	10	1.4	5.2	0.2	0.5	0.2	0
Grey	3	3.4	18.9	0.6	3.9	0	0

CROP / CULTURE: Winter Wheat

LOCATION / RÉGION: Manitoba

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: FUSARIUM HEAD BLIGHT OF WINTER WHEAT IN MANITOBA IN 2000

INTRODUCTION AND METHODS: The occurrence of fusarium head blight (FHB) in winter wheat in southern Manitoba was assessed by surveying 47 farm fields from July 13 to 23, 2000. Because winter wheat is not widely grown in Manitoba (in 2000 it was planted on about 2% of the total wheat acreage - Manitoba Crop Insurance Corp.) the fields were not surveyed at random; rather, their locations were specified by Manitoba Agriculture extension personnel and confirmed by contacting producers. Fusarium head blight in each field was assessed by rating a minimum of 80-100 plants at each of 3 locations for percentage of infected spikes (disease incidence), and for the average proportion of the head affected (severity). Disease levels were calculated as the 'FHB Index' (% incidence x % severity / 100). Ten affected heads closest to each of the 3 plant clumps sampled were collected from each location, placed in plastic bags and frozen. Subsequently, 50 seeds from blighted portions of heads were surface-sterilized in 0.3% NaOCl for 3 min., air-dried, and plated onto potato dextrose agar to quantify and identify the *Fusarium* spp. present.

RESULTS AND COMMENTS: Conditions initially were cool and relatively dry, and unfavourable for development of FHB in Manitoba, but by mid-June frequent and above-normal levels of rain ensued, and persisted for the remainder of the growing season. Winter wheat normally flowers earlier than spring-seeded crops, and because of this is considered to escape FHB infection in some years. Despite apparent adequate moisture when winter wheat headed/flowered in 2000, levels of FHB in the crop were relatively low. Possibly, inoculum was not yet abundant due to prior cooler and drier conditions.

Of the 47 fields surveyed, six had no plants with visible symptoms of FHB. Overall, incidence of FHB was 8.2% (range 0 - 40%), severity 13.6% (range 0 - 38%) and the FHB Index 1.6% (range 0 - 15.2%). As such, FHB was estimated to have caused yield losses in commercial winter wheat of about 0.5%. This yield loss is considerably lower than that estimated in 1998, but higher than that in 1999 (Tekauz et al. 2000).

The *Fusarium* spp. and their levels on seed are listed in Table 1. As has been normal for all types of wheat grown in Manitoba, *F. graminearum* was the principal pathogen.

REFERENCES:

Tekauz, A., J. Gold, J. Gilbert, M. Idris, M. Stulzer, M. Beyene and S. Ramanciauskas. 2000. Fusarium head blight in winter wheat in Manitoba in 1999. Can. Plant Dis. Surv. 80:66. (http://res2.agr.ca/london/pmrc/ pmrchome.html)

Table 1. *Fusarium* spp. isolated from Manitoba winter wheat kernels in 2000.

***FUSARIUM* SPP.**	**PERCENT OF FIELDS**	**PERCENT OF KERNELS**
F. graminearum	87.2	84.4
F. avenaceum	27.7	1.1
F. poae	12.8	0.3
F. sporotrichioides	10.6	0.4
F. equiseti	4.3	0.1
F. culmorum	6.4	0.3

CROP / CULTURE: Winter wheat

LOCATION / RÉGION: Manitoba

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: LEAF SPOTS OF WINTER WHEAT IN MANITOBA IN 2000

INTRODUCTION AND METHODS: Foliar diseases of winter wheat in Manitoba were assessed by surveying 47 farm fields from July 13 to 23, when crops were at the early milk to soft dough stage (ZGS 68-86). Because winter wheat occupies a small acreage in Manitoba (in 2000 it was planted on about 2% of the total wheat acreage - Manitoba Crop Insurance Corp.) the farm fields were not surveyed at random; rather, their locations were specified by Manitoba Agriculture extension personnel and confirmed by contacting producers. Fields surveyed were located in southern Manitoba, in the area bounded by Hwy #16 and the US border, Brandon in the west and Dugald to the east. Disease severity was recorded by sampling approximately 10 plants along a diamond-shaped transect of about 50 m per side, beginning near the field edge. Severity ratings were taken on both the upper (usually the flag leaf) and lower leaf canopies, using a six-category scale: 0 or nil (no visible symptoms); trace (<1% leaf area affected); very slight (1-5%); slight (6-15%); moderate (16-40%); and severe (41-100%). Infected leaves with typical symptoms were collected at each site and dried and stored in paper envelopes. Surface-sterilized pieces of infected leaf tissue were placed in moist chambers for 3-5 days to identify the causal pathogen(s) and determine the disease(s) present.

RESULTS AND COMMENTS: Conditions in Manitoba in 2000 were generally cool and dry in the early part of the growing season (to early June) and then became warmer and quite wet. Thus, winter wheat and early-seeded spring crops suffered relatively little damage from leaf spots, compared to crops seeded later, which evolved for a longer period during conditions more conducive to leaf spot development.

Leaf spots were observed in the upper and/or lower leaf canopies of all winter wheat fields surveyed. Disease severities in the upper canopy were nil, trace or very slight in 21 % of fields, slight in 45%, moderate in 17%, severe in 8% and senescent in 9%. Respective severity categories in the lower canopy were tabulated as 2%, 15%, 21%, 7% and 55%. Based on disease development in the upper canopy (>60% of fields with only trace to moderate leaf spotting), foliar diseases in winter wheat in 2000 caused little damage, likely less than a 2% yield loss. This is less damage than observed in 1999. Spot blotch, caused by *Cochliobolus sativus*, and tan spot, caused by *Pyrenophora tritici-repentis,* were the most prevalent diseases (Table 1), but the contribution of tan spot to the leaf spot complex was considerably lower than found in 1999 (Tekauz et al. 2000).

REFERENCES:

Tekauz, A., et al. 2000. Leaf spots of winter wheat in Manitoba in 1999. Can. Plant Dis. Surv. 80: 67. (http://res2.agr.ca/london/pmrc/)

Table 1. Prevalence and isolation frequency of leaf spot pathogens of winter wheat in Manitoba in 2000

PATHOGEN	PREVALENCE (% OF FIELDS)	DAMAGE (% OF ISOLATIONS)
Cochliobolus sativus	31.9	46.4
Pyrenophora tritici-repentis	21.3	25
Stagonospora nodorum	12.8	16.1
Septoria tritici	8.5	8.9
Septoria avenae f.sp. *triticea*	4.3	3.6

Oilseeds and special crops /oléagineux et cultures spéciales

CROP: Canola

LOCATION: Alberta

NAME AND AGENCY:

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TITLE: SURVEY OF FUSARIUM WILT AND OTHER CANOLA DISEASES IN ALBERTA, 2000

METHODS: A total of 90 *Brassica* fields, most of which were *B. napus* (except as noted), were surveyed between August 2 and August 24 in the important canola production areas of Alberta, including the north Peace (20 fields), south Peace (30), central (10), east central (19), and south (11). The fields were surveyed before swathing, mostly at crop growth stages 5.1 to 5.3 (Harper and Berkenkamp, 1975). Disease assessments were made by rating 100 randomly selected plants from each field. The presence or absence of lesions on each plant was determined to give percent disease incidence for the following diseases: sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), fusarium wilt (*Fusarium spp.*), foot rot (*Fusarium spp., Rhizoctonia solani*), brown girdling root rot (*Rhizoctonia solani*), aster yellows (AY phytoplasma), and staghead (*Albugo candida*). For sclerotinia stem rot, each plant was scored for either a main stem lesion or an upper stem or pod lesion. For alternaria pod spot, (*Alternaria brassicae, A. raphani*), the percent severity of lesions on the pods of each plant was assessed (Conn et al., 1990). If alternaria pod spot was observed in a field, but at a level estimated to be below 1%, the disease was recorded as a "trace". When other diseases were observed in a field, but not in the sample of 100 plants, the disease was also recorded as a "trace". When calculating means, all trace values were recorded as 0.1%. The results for each region were combined and mean disease incidence or severity values were determined.

RESULTS AND COMMENTS: Fusarium wilt was observed in 14 of the 90 fields, and incidence values ranged from 0 to 72%. Mean incidence was by far the highest in the east central area while no fusarium wilt was reported in the south or the south Peace (Table 1). Plants with symptoms of both fusarium wilt and blackleg were observed in two fields in the Medicine Hat area; these plants were not included in the calculations of fusarium wilt incidence due to the difficulty in reliably distinguishing symptoms. The provincial average was 2.0%. This disease was first reported in 1999 (Lange et al., 2000), and the incidence observed this season represents a potential spread that should be watched closely.

Sclerotinia stem rot was observed in 68 of the 90 fields and incidence values ranged from 0 to 53% for main stem lesions and from 0 to 67% for upper stem/pod lesions. Mean incidence was highest in the east central region and lowest in the south, where there was no sclerotinia reported (Table 1). The provincial average was 7.3% for main stem lesions and 5.4% for upper stem/pod lesions.

Blackleg was found in 38 of the 90 fields and incidence values ranged from 0 to 66%. Mean incidence was by far the highest in the east central area, while values in all other areas were low (Table 1). The provincial average incidence was 5.6%. In at least two fields, a moderately resistant cultivar was found to have a high or fairly high level of blackleg. In a field near Sedgewick, 66% of cv. LG3345 plants rated had blackleg lesions, while a cv. Quest field near Ryley (Vegreville area) showed a 26% incidence of blackleg.

Foot rot was observed in 17 of the 90 fields, and incidence values ranged from 0 to 47%. Mean incidence was highest in the central region followed by the east central region and lowest in the south Peace, where none was reported (Table 1). The provincial average was 1.6%.

Brown girdling root rot was highest in the Peace, with the north Peace higher (14%) than the south Peace (11%), but negligible (0.2% or less) in the rest of the province (Table 1). It was found in 53 of the 90 fields, and incidence values ranged from 0 to 36%.

Aster yellows was observed in 22 of the 90 fields, with incidence values ranging from 0 to 12%, although all but one field (near Vegreville) showed values of 3% or less. Low values across the province gave a provincial average of only 0.3%; however, general field observations indicated that aster yellows was more prevalent in 2000 than in previous years. An unusually high amount of purpling of canola was noticed in many fields across the province. Preliminary tests indicate that this might be related to aster yellows infection, but further testing is required.

Staghead was found in 15 of the 90 fields, with incidence values ranging from 0 to 20% and a provincial average of 0.6%. Usually the fields either contained *B. rapa*, or the staghead was on volunteer *B. rapa* in *B. napus* fields. Two *B. rapa* fields near Beaverlodge showed significant levels (20% each). The south Peace had the only incidence over 1%, with a 1.6% value.

Alternaria pod spot was found in 57 of the 90 fields. The highest severity (8%) was found in a field near Bonnyville. The provincial average was 0.4%, indicating that alternaria severity levels were below average in 2000.

REFERENCES:

Conn, K.L., J.P. Tewari, and R.P. Awasthi. 1990. A disease assessment key for Alternaria black spot in rapeseed and mustard. Can. Plant Dis. Surv. 70:19-22.

Harper, F. R., and B. Berkenkamp. 1975. Revised growth-stage key for *Brassica campestris* and *B. napus*. Can. J. Plant Sci. 55:657-58.

Lange, R. M., L. M. Harrison, and P. D. Kharbanda. 2000. A new Fusarium wilt of canola in Alberta, Canada in 1999. Abstracts of papers presented at joint meeting of Can. Phytopathol. Soc. and Pacific Division of Amer. Phytopathol. Soc., June 18-21, 2000, Victoria, BC, Canada, p. 25.

Table 1. Canola diseases in Alberta in 2000.

Region[1] (No. of fields)	% DISEASE INCIDENCE								DISEASE SEVERITY %
	Sclerotinia[2]		Black-leg	Fusarium wilt	Foot rot	Brown girdling rot rot	Aster yellows	Stag-head	
	Main	Upper/pod							
North Peace									
-20	8.7	4.6	T[3]	0.8	0.3	14	0.2	0.2	0.2
South Peace									
-30	6.3	1.9	0.4	0	0	11	T	1.6	T
Central									
-10	8.2	7.2	1.6	0.6	5.2	0.2	T	T	0.3
East Central									
-19	11	14	22.0	8.3	4.2	0.2	1.0	T	1.3
South									
-11	0	0	2.1	0	0.4	6.9	0.3	0.6	0.4
Overall									
-90	7.3	5.4	5.6	2	1.6	6.9	0.3	0.6	0.4

[1] The regions surveyed included the following cities and towns:
North Peace = Fairview, Grimshaw, Manning, Fort Vermilion, La Crete
South Peace = Beaverlodge, Falher, La Glace, Nampa, Spirit River, Wanham, Eaglesham
Central = Leduc, Stony Plain
East Central = Bonnyville, Sedgewick, Vegreville
South = Vulcan, Medicine Hat

[2] Sclerotinia stem rot lesions were scored either as a main stem lesion or as an upper stem/pod lesion.

[3] T = Trace amounts of disease (<0.1%) or disease was not found in the 100 plant samples but was noted in the field. Trace values were considered as 0.1% for calculating means.

CROP: Canola

LOCATION: Saskatchewan

NAME AND AGENCY:

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TITLE: SURVEY OF CANOLA DISEASES IN SASKATCHEWAN, 2000

METHODS: A total of 103 fields of *Brassica napus* were surveyed between August 14 and 23 in the major canola production regions of Saskatchewan including the north-east (17), north-central (17), north-west (17), east-central (28), central (8) and south-east (16). Canola fields were surveyed before swathing and when the crop was between growth stages 5.2 and 5.3 (Canola Council of Canada). Disease assessments were made in each field by collecting 20 plants at each of 5 sites separated by at least 20 m and 20 m from the edge of the field. The presence or absence of lesions on each plant was determined to give percent disease incidence for the following diseases: sclerotinia stem rot (*Sclerotinia sclerotiorum*), blackleg (*Leptosphaeria maculans*), aster yellows (AY phytoplasma), and foot rot (*Rhizoctonia, Fusarium*). For sclerotinia stem rot, each plant was scored for either a main stem lesion or an upper branch/pod lesion. For blackleg, each plant was scored for either a severe basal stem canker or any other type of blackleg stem lesion. For alternaria pod spot (*Alternaria brassicae*, *A. raphani*), the percent severity of lesions on the pods of each plant was assessed. If alternaria pod spot was present in a field, but at a level estimated to be below 1%, the disease was recorded as a "trace". Similarly, when the other diseases were observed in a field, but not in the sample of 100 plants, the disease was recorded as a "trace". When calculating means, all trace values were counted as 0.1%. Field results were combined for each region and mean disease incidence or severity values were determined.

RESULTS AND COMMENTS: Sclerotinia stem rot was observed in 81 of the 103 fields surveyed and incidence values ranged from 0 to 44% for main stem lesions and from 0 to 52% for upper branch/pod lesions. Mean incidence was highest in the north-central region, followed closely by the north-east region and lowest in the east-central and south-east regions (Table 1). The overall mean incidence values for the province were 8% main stem lesions and 6% upper branch/pod lesions, indicating a yield loss to canola producers of approximately 7% (Morrall et al., 1984). Incidence values were lower in 2000 than 1999 but were similar to most other years (Pearse et al. 2000; Canola Council of Canada; R.A.A. Morrall, unpublished data). Although weather conditions in some parts of the province were conducive to sclerotinia stem rot, canola crops were generally less dense and lower yielding this season as a result of environmental stresses.

Blackleg was observed in 71 of the 103 fields surveyed. Mean incidence values ranged from 0 to 17% for basal stem lesions and 0 to 24% for lesions occurring elsewhere on the stem. Blackleg incidence values were highest in the north-west region, moderate in the north-central region and relatively low elsewhere in the province (Table 1). The overall mean incidence values for the province were 1% for basal stem cankers and 3% for lesions found elsewhere on the stem. Approximately 68% of blackleg lesions were scored as occurring not as basal stem cankers but elsewhere on the stem, indicating limited impact on seed yield and quality.

Aster yellows was observed in 92 of the 103 fields surveyed. Overall mean incidence for the province was 1.6% (Table 1). Incidence ranged from 0 to 10%. Although aster yellows incidence was highest in the north-central region, it was prevalent in all regions of the province surveyed. Aster yellows incidences were slightly higher in 2000 and 1999 than in previous years. This suggests that environmental conditions may have been favourable for the early and abundant migration of leafhoppers into the province.

Foot rot was observed in 40 of the 103 fields surveyed. Disease incidence ranged from 0 to 14% with the highest incidence in the north-east region, followed closely by the north-central and central regions (Table 1). The overall mean incidence for the province was 1.2%.

Alternaria pod spot was observed in 86 of the 103 fields surveyed but mostly at trace severity levels. The highest mean severity was observed in the south-east region (Table 1). In late summer, the south-east region experienced periods of high relative humidity, conditions that favour pod spot development. This survey was conducted before swathing so severity may have been lower than at harvest, when pod spot development typically increases.

Fusarium wilt (*Fusarium avenaceum*) was confirmed in one sample collected in the south-east region (Lange et al., 2000). There were no reports of brown girdling root rot or staghead in any of the fields surveyed.

REFERENCES:

Canola Council of Canada. (http://www.canola-council.org/manual/Canolaframes.html)

Lange, R.M., L.M. Harrison and P.D. Kharbanda. 2000. A new fusarium wilt of canola in Alberta, Canada in 1999. Abstracts of papers presented at joint meeting of Can. Phytopathol. Soc. and Pacific Div. of Amer. Phytopathol. Soc., June 18-21, 2000, Victoria, B.C. p. 25.

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Pearse, P.G., R.A.A. Morrall, 2000, R. Kutcher, D.A. Kaminski, L.J. Duczek, R.K. Gugel, S.R. Rimmer, R. Berard. 2000. Survey of canola diseases in Saskatchewan, 1999. Can. Plant Dis. Surv. 80:81-82. (http://res2.agr.ca/london/pmrc/english/report/disease2000.html)

Table 1. Canola diseases in Saskatchewan in 2000.

REGION[1] (NO. OF FIELDS)	**MEAN % DISEASE INCIDENCES**						**Mean % Severity**
	Sclerotinia[2]		Blackleg[3]		Aster yellows	Foot rot	Alternaria pod spot
	Main	Upper	Basal	Other			
North-east							
-17	14	13	T[4]	1	1.9	1.8	0.3
North-central							
-17	17	14	3	3	2.4	1.6	0.4
North-west							
-17	3	3	4	7	0.6	1	0.3
East-central							
-28	1	T	T	3	1.7	0.4	0.9
Central							
-8	8	8	1	3	1.3	1.6	0.1
South-east							
-16	3	1	T	2	1.4	0.5	1.1
Overall Mean							
-103	8	6	1	3	1.6	1.2	0.5

[1] The Rural Municipalities (RM) surveyed in the major canola production regions included:
North-east = RM 426, 427, 428, 456, 457, 458
North-central = RM 429, 430, 459, 460, 461, 463, 464, 493
North-west = RM 347, 379, 406, 437, 438, 470, 471
East-central = RM 185, 214, 215, 216, 276, 277, 308, 336, 244, 247, 248, 279
Central = RM 285, 313, 373, 342, 343, 403, 405
South-east = RM 66, 67, 68, 96, 156, 159, 160, 187, 189

[2] Sclerotinia stem rot lesions were scored as either a main stem lesion or as an upper branch/pod lesion.

[3] Blackleg lesions were scored as either a severe basal stem canker or as any other type of stem lesion.

[4] T = trace amounts of disease (< 1%); or, were not found in the 100 plant sample but present in the field. In calculating means, trace values are 0.1%.

CROP: Canola

LOCATION: Manitoba

NAME AND AGENCY:

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TITLE: DISTRIBUTION, PREVALENCE AND INCIDENCE OF CANOLA DISEASES IN MANITOBA (2000)

METHODS: In August and September of 2000, 317 canola crops were surveyed in the eastern/interlake (56), southwest (101), northwest (78) and central (82) regions. All crops were *Brassica napus*. All crops were assessed for the prevalence (percent crops infested) and incidence (percent plants infected per crop) of sclerotinia stem rot (*Sclerotinia sclerotiorum*), aster yellows (phytoplasma), staghead (*Albugo candida*), foot rot (*Fusarium* spp. and *Rhizoctonia* sp.), blackleg (*Leptosphaeria maculans*) and fusarium wilt (*Fusarium* spp.). Blackleg lesions that occurred on any part of the canola stem were assessed separately from basal stem cankers. The prevalence and percent severity of alternaria pod spot (*Alternaria* spp.) was determined.

In each canola crop, 100 plants were selected in a regular pattern starting at a corner of the field or at a convenient access point. The edges of the fields were avoided. Twenty plants were removed from each of five points of a "W" pattern in the field. Points of the "W" were at least 20 paces apart. All plants were pulled up, removed from the field and examined for the presence of diseases.

RESULTS: A number of diseases were present in each of the four regions of Manitoba. Sclerotinia stem rot and blackleg were the most prevalent diseases throughout the province (Table 1). The prevalence of sclerotinia-infested crops ranged from a high of 92% in the southwest region to 68% in the eastern/ interlake region with a provincial mean of 81%. This increased from a prevalence of 60% in 1999 (McLaren and Platford, 2000). Mean disease incidence ranged from 15% in the southwest region to 8% in the eastern/interlake region. The provincial mean of 14% was greater than in 1999 and probably resulted in about a 7% yield loss. In 2000, moist conditions during late June and July were favourable for the development of sclerotinia stem rot and produced conditions that increased disease risk in many areas.

Blackleg basal cankers occurred in 45% of the crops surveyed in 2000 with mean disease incidence ranging from 14% in the southwest region to 3% in the northwest region and a provincial mean of 9%. The average incidence was higher in 1999, with the highest value of 29% occurring in the southwest region (McLaren and Platford, 2000). When blackleg was detected in the crops surveyed in 2000, severe symptoms were observed in many cases. These caused a yield loss estimated at about 5% on a province-wide basis.

The mean prevalence of blackleg stem lesions was less than during the last two field seasons, with 72%, 66% and 54% of crops infested with stem lesions in 1998 (McLaren and Platford, 1999), 1999 (McLaren and Platford, 2000) and 2000, respectively. The mean incidence in 2000 was 7%, similar to that in 1999 (McLaren and Platford, 2000).

The severity of alternaria pod spot was low, with means of <3% in the southwest and northwest regions (Table 2). No alternaria was reported on the 100-plant samples from surveyed crops in the central and eastern/interlake regions. The highest prevalence (31%) occurred in the southwest region (Table 1). In the northwest region, 22% of the crops surveyed for alternaria pod spot were infested. These values decreased from prevalences of 97% in the southwest region and 95% in the northwest region in 1999. Although this disease was most prevalent in the western part of the province in both years, above normal precipitation was received in western and southwestern Manitoba in 1999.

The prevalence of aster yellows in the 2000 surveyed crops ranged from 70% in the southwest region to 5% in the central region with a provincial mean of 40%. This decreased from a prevalence of 56% in 1999 (McLaren and Platford, 2000). The average disease incidence was 2% in the central region and 3% in all other regions.

Other diseases that were observed in the surveyed crops were foot rot (in 4% of fields) and staghead (on volunteer *B. rapa*) in 1% of the fields. The mean disease incidence for foot rot was below 5%. The disease incidence for staghead was always below 5%.

Fusarium wilt was observed for the first time in 1% of canola fields in Manitoba. The disease incidence was below 5%.

REFERENCES:

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2. McLaren, D.L. and Platford, R.G. 2000. Distribution, prevalence and incidence of canola diseases in Manitoba (1999). Can. Plant Dis. Surv. 80: 79-80. (http//:res2.agr.ca/london/pmrc/pmrchome.html)

ACKNOWLEDGEMENTS: We thank the Manitoba Canola Growers Association for financial support and the Manitoba Crop Insurance Corporation for providing a database of canola fields. The assistance of J.L Lamb in conducting this survey is also gratefully acknowledged as is the technical support of T. Henderson and B. Mitchell.

Table 1. Number of canola crops surveyed and disease levels in Manitoba in 2000 [1].

Crop Region	No. of crops surveyed	DISEASE LEVELS									
		Sclerotinia stem rot		Blackleg				Aster yellows		Alternaria pod spot	
				basal cankers		stem lesions					
		P[1]	DI[2]	P	DI	P	DI	P	DI	P	Mean % severity
E/I	56	68	8	50	7	64	10	16	3	0	0
Central	82	73	15	63	7	62	7	5	2	0	0
SW	101	92	15	52	14	55	6	70	3	31	2.6
NW	78	85	12	14	3	37	7	55	3	22	1.5

[1] Staghead was observed in two fields in the southwest region; fusarium wilt was observed in two fields in the eastern/interlake region. Although not observed in the surveyed crops in this study, fusarium wilt was also noted in one field in the central region.

[2] Mean percent prevalence.

[3] Mean percent disease incidence.

Table 2. Distribution of incidence (sclerotinia stem rot, blackleg, aster yellows, staghead[1] and fusarium wilt) and severity (alternaria pod spot) classes in 317 crops of *Brassica napus* in Manitoba in 2000.

	PERCENTAGE OF CROPS WITH						
	Sclerotinia stem rot	Blackleg		Alternaria pod spot	Aster yellows	Staghead	Fusarium wilt
		basal	stem				
0	21	54	46	84	60	99	99
1-5%	27	26	34	14	36	1	1
6-10%	18	8	9	1	3	0	0
11-20%	17	7	7	1	1	0	0
21-50%	15	3	3	0	0	0	0
>50%	2	2	1	0	0	0	0

[1] Plants with staghead were volunteer *B. rapa*.

CROPS: Chickpea

LOCATION: Saskatchewan

NAMES AND AGENCIES:

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TITLE: SEED-BORNE PATHOGENS OF CHICKPEA IN SASKATCHEWAN IN 2000

METHODS: The results of agar plate tests conducted by four Saskatchewan companies on seed samples from the 2000 crop were summarized separately for kabuli and desi chickpea. The tests were conducted mainly to detect the pathogens causing ascochyta blight (*Ascochyta rabiei*), botrytis blight [grey mould] (*Botrytis cinerea*) and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). Not all samples were tested for *Botrytis* and *Sclerotinia* but all were tested for *Ascochyta*. Figures for *Ascochyta* and *Botrytis* were classified according to crop districts [CD] of Saskatchewan (1). However, this was not done for *S. sclerotiorum* because infection levels are generally so low that comparisons of means would be valueless.

It was unknown which of the samples came from crops that had been treated with registered fungicides. Bravo (a.i. chlorothalonil) is widely used as a foliar protectant on chickpea. Apron (a.i. metalaxyl) is generally used as a seed treatment on kabuli chickpea.

RESULTS AND COMMENTS: In most areas of Saskatchewan the growing season started with relatively dry conditions that resulted in early completion of seeding in May. From June to early August rainfall amounts varied from about 50% to 200% of normal in different crop districts, with the wettest conditions generally in the northeast, southeast and south central areas. These included some of the main areas of chickpea production in southern Saskatchewan and contributed to extensive spread of ascochyta blight in many crops as well as rank growth that contributed to botrytis blight infection. In late August good harvest weather prevailed throughout the province, but in early September rain and warm humid weather caused deterioration of crop quality in many areas. The average provincial yield (kabuli and desi combined) was similar to that in 1999, but only about 95% of the seeded area was harvested, largely due to crop failures due to diseases.

By mid-December almost 1200 chickpea seed samples (nearly 900 kabuli, 200 desi and about 100 non-specified) had been tested by the four companies. The 40% increase over 1999 (2) reflects a large increase in acreage.

Levels of seed-borne *Ascochyta* varied among crop districts (Table 1), and were generally lowest in CD 2A, 4A and 4B. The provincial mean for desi chickpea was lower than that for kabuli, possibly reflecting a difference in leaf types between the two. The majority of kabuli cultivars grown in Saskatchewan have unifoliolate leaves while the majority of desi cultivars have fern-type leaves. Agronomists and growers noted during the season that ascochyta blight tended to be more severe on chickpea crops with unifoliolate leaves than on those with fern-type leaves (mainly desi cv. Myles and kabuli cv. B-90). The maximum recorded values of ascochyta seed infection were 46.25% in kabuli for a sample from CD 6A and 15.25% in desi for a sample from CD 3A-S.

The overall percentages of samples in which no ascochyta was detected were 27 for kabuli and 41 for desi. Direct comparisons with previous years of mean infection levels or percent samples with no infection are not possible because in previous years figures were not separated for kabuli and desi chickpea (2,3,4). However, the mean infection levels for both kabuli and desi in 2000 were higher than the overall mean in 2000; in turn, this figure was higher than the corresponding figures for 1998 and 1997. Clearly ascochyta blight was a major problem in chickpea production in 2000, despite widespread use of moderately resistant cultivars and applications of Bravo.

Botrytis was detected in 48% of the kabuli samples tested and 72% of the desi samples (Table 2). In 1999 the corresponding figure for both types of chickpea combined was 50%, weighted 2/3 towards kabuli (2). Thus, there was probably little change in mean prevalence of *Botrytis* on kabuli chickpea between 1999 and 2000. However, mean provincial infection levels in 2000 were 1.7% for kabuli and 2.5% for desi, both substantially higher than the combined mean of 0.7% reported in 1999. The highest individual values recorded in 2000 were 24.25% in kabuli and 23.5% in desi, both for samples from CD 2A.

The difference in *Botrytis* infection levels between kabuli and desi seed can probably be attributed mainly to the tendency of growers to plant desi cultivars in areas where chickpea is less well adapted (more rainfall and heavier soils). These conditions favor rank growth and *Botrytis* infection in late summer. Thus, the provincial average infection level for *Botrytis* in kabuli is highly influenced by the fact that nearly 30% of the samples came from CD 4A and 4B, where chickpea is well adapted and *Botrytis* levels were low (Table 2). On the other hand, only 9% of desi samples came from CD 4A and 4B and this had less effect on the provincial average. However, in contrast to 1999 (2), high *Botrytis* levels did occur within some of the area of optimum adaptation of chickpea in Saskatchewan (i.e. CDs 3A-S, 3B-N, 3B-S, 4A, 4B, and 7A) because of above-normal rainfall.

Sclerotinia sclerotiorum was isolated from a small percentage of kabuli and desi chickpea seed samples in 2000 and in these most commonly at levels of 1.0% or less.

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Table 1. Number of chickpea seed samples tested from August to mid-December, 2000 by four commercial companies and mean percent infection with *Ascochyta* in relation to Saskatchewan Crop Districts.

Crop District	**KABULI**			**DESI**			**NON-SPECIFIED**	
	No. of samples tested	Mean % infection	% samples with 0% infection	No. of samples tested	Mean % infection	% samples with 0% infection	No. of samples tested	Mean % infection
1A	2	2.6	0	1	0.3	0	1	1.5
1B	2	2	0	0	-	-	0	-
2A	30	0.8	50	11	<0.1	91	3	1.9
2B	59	3.4	24	19	0.9	58	4	4.3
3AN	62	3.5	31	19	2.5	21	6	0.5
3AS	93	3.3	22	28	2.8	14	12	1.1
3BN	160	1.5	26	44	0.6	45	20	0.5
3BS	121	3.5	12	7	1.7	43	39	1.1
4A	187	0.5	34	5	0.2	40	4	0
4B	42	0.4	36	15	0.2	67	7	0.4
5A	7	3.8	29	1	0	100	0	-
5B	0	-	-	0	-	-	0	-
6A	23	7.9	13	16	3.3	6	2	1.5
6B	21	3	29	28	1.7	21	1	0
7A	71	2.4	32	14	0.6	57	1	9.5
7B	2	3.8	50	2	0	100	0	-
8A	0	-	-	0	-	-	0	-
8B	0	-	-	0	-	-	3	0
9A	0	-	-	0	-	-	0	-
9B	0	-	-	0	-	-	0	-
TOTAL	882	2.3	27	200	1.5	41	103	1

Table 2. Number of chickpea seed samples tested from August to mid-December, 2000 by four commercial companies and mean percent infection with *Botrytis* in relation to Saskatchewan Crop Districts.

Crop District	KABULI			DESI			NON-SPECIFIED	
	No. of samples tested	Mean % infection	% samples with 0% infection	No. of samples tested	Mean % infection	% samples with 0% infection	No. of samples tested	Mean % infection
1A	1	4	0	1	12.3	0	0	-
1B	2	0.5	0	0	-	-	0	-
2A	25	3.7	32	8	13.2	0	0	-
2B	56	5.7	18	16	4.7	0	3	3
3AN	53	2.3	28	16	1.3	25	2	0
3AS	74	3.5	22	26	2.2	8	6	0.2
3BN	144	1	48	42	0.8	35	9	<0.1
3BS	105	1.8	56	5	0.4	60	33	<0.1
4A	178	0.1	76	4	0	100	2	0.1
4B	40	0.2	70	13	0	100	7	0.4
5A	7	5.1	43	1	0	100	0	-
5B	0	-	-	0	-	-	0	-
6A	21	2.7	14	17	5.4	0	1	8.8
6B	13	2.2	15	24	2.3	21	0	-
7A	62	0.6	63	14	0.4	43	1	0.8
7B	2	1	0	2	2.1	0	0	-
8A	0	-	-	0	-	-	0	-
8B	0	-	-	0	-	-	0	-
9A	0	-	-	0	-	-	0	-
9B	0	-	-	0	-	-	0	-
TOTAL	753	1.7	52	186	2.5	28	64	0.4

CROP / CULTURE: Chickpea (*Cicer arietinum* L.)

LOCATION / REGION: Saskatchewan

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE: DISEASE SURVEY OF CHICKPEA IN WEST-CENTRAL SASKATCHEWAN IN 2000

INTRODUCTION AND METHODS: A survey for chickpea diseases was conducted in fields randomly selected near Rosetown, Eatonia, Lemsford, Lancer, Cabri, Pennant, Success, Stewart Valley and Demaine in west-central Saskatchewan (Fig. 1). Five plants in the pod-fill stage were sampled at each of four random sites for each of 59 chickpea fields between July 17 and 21, 2000. Root disease severity was estimated using a scale of 0 to 4 (0 = no disease, 1 = small lesions, 2 = large lesions, 3 = plant girdled, and 4 = plant dead). The incidence of ascochyta blight and other diseases was recorded. All diseased plant samples were cultured onto various agar media in the laboratory to retrieve causal pathogens. Information on cultivar and seed treatment were obtained from the growers, and the rates of seed treatment were provided by Gustafson®. Data were analysed using the general linear model with the SAS System 6.12.

RESULTS AND COMMENTS: Ascochyta blight (*Ascochyta rabiei*) and root rot (*Fusarium* spp., *Pythium* spp., and *Rhizoctonia solani*) of chickpea were most the common diseases observed in the fields and causal pathogens were recovered from plant samples. Alternaria leaf spot (*Alternaria* spp.) and sclerotinia stem rot (*Sclerotinia sclerotiorum*) were also present (Table 1).

Overall, ascochyta blight was identified in 57 of the 59 fields surveyed with a fairly high incidence in each field. There was no significant difference in the incidence of ascochyta blight across the surveyed area. There was no significant difference ($P = 0.22$) in incidence of *Ascochyta* infection between Desi cvs. CDC Anna and Myles and Kabuli cvs. CDC Yuma, Evans, Sanford, B90, Dwelley and CDC Xena (data not shown). Root rot diseases were observed in 32 of the 59 fields surveyed. In most, *Fusarium* and *Pythium* were identified as the causal agents. A few of the samples had *Rhizoctonia*-induced root disease (Table 1). However, root rot incidence varied with location and seed types. There was a much higher incidence of root rot diseases in the areas of Demaine, Rosetown, Pennant and Success than in the other areas surveyed. Kabuli cultivars usually had a lower root rot incidence than the Desi cultivars (Table 2), probably because seed treatment was not applied in 7 of the 11 Desi chickpea fields.

Only three cultivars of Kabuli exhibited low root rot with disease incidence ranging from 0 to 5.0% and disease severity less than 0.1 on the 0 - 4 scale. Chemical seed treatments were applied in 52 of the 59 fields by commercial seed suppliers. Three different seed treatments were used, including Crown (92 g/L carbathiin + 58 g/L thiabendazole) at 300 mL + Apron (metalaxyl) at 16 mL/100 kg seed, Vitaflo 280 (thiram 130 g a.i./L + carbathiin 150 g a.i./L) at 260 mL + Apron (metalaxyl) at 16 mL/100 kg seed, and Apron (metalaxyl) alone at 16 mL/100 kg seed. All three treatments significantly (P • 0.01) reduced root rot diseases compared to non-treated fields, although there was no difference among the three seed treatments (Table 3).

We gratefully acknowledge the assistance of David Nobbs of Gustafson® at Rosetown, Saskatchewan in carrying out this survey.

Table 1. Summary of common diseases observed on chickpea in west-central Saskatchewan in 2000.

DISEASE	CAUSAL AGENT	NO. FIELDS INFESTED	LOCATION
Ascochyta blight	*Ascochyta rabiei*	57	Cabri, Demaine, Eatonia, Lancer, Pennant, Rosetown, Stewart Valley, Success
Fusarium root rot	*Fusarium* spp.	15	Demaine, Eatonia, Lancer, Pennant, Rosetown
Pythium root rot	*Pythium* spp.	13	Demaine, Eatonia, Lancer, Pennant, Rosetown
Rhizoctonia root rot	*Rhizoctonia solani*	4	Cabri, Eatonia, Success.
Alternaria leaf spot	*Alternaria* spp.	3	Demaine, Eatonia.
Sclerotinia stem rot	*Sclerotinia sclerotiorum*	3	Eatonia, Success.

Table 2. Root rot diseases and ascochyta blight on chickpea in west-central Saskatchewan in 2000[1].

	NO. FIELDS SURVEYED	ROOT ROTS[2]			ASCOCHYTA BLIGHT INCIDENCE (%)	
		INCIDENCE (%)		SEVERITY (0-4)		
Location						
Rosetown	8	25	(25.0 - 60.0)	0.4 (0 - 1.0)	21.3	(0 - 30.0)
Pennant	6	20	(0 - 45.0)	0.3 (0 - 0.7)	50	(10.0 - 100.0)
Success	7	17.9	(0 - 35.0)	0.3 (0 - 0.5)	56.4	(20.0 - 85.0)
Demaine	12	17.1	(0 - 45.0)	0.3 (0 - 0.9)	49.2	(0 - 100.0)
Eatonia	17	5.9	(0 - 25.0)	0.1 (0 - 0.4)	52.1	(20.0 - 100.0)
Lancer	6	4.2	(0 - 15.0)	0.1 (0 - 0.3)	28.3	(10.0 - 80.0)
Cabri	1	5		0.1	30	
Lemsford	1	0		0	15	
Stewart	1	0		0	60.0	
Seed type						
Desi	11	29.1	(0 - 60.0)	0.5 (0 - 1.0)	30.9	(0 - 100.0)
Kabuli	48	9.6	(0 - 45.0)	0.1 (0 - 0.9)	47.4	(0 - 100.0)

[1] Means are presented with the range in parentheses under each category.

[2] Root rot diseases include fusarium, pythium and rhizoctonia root rot.

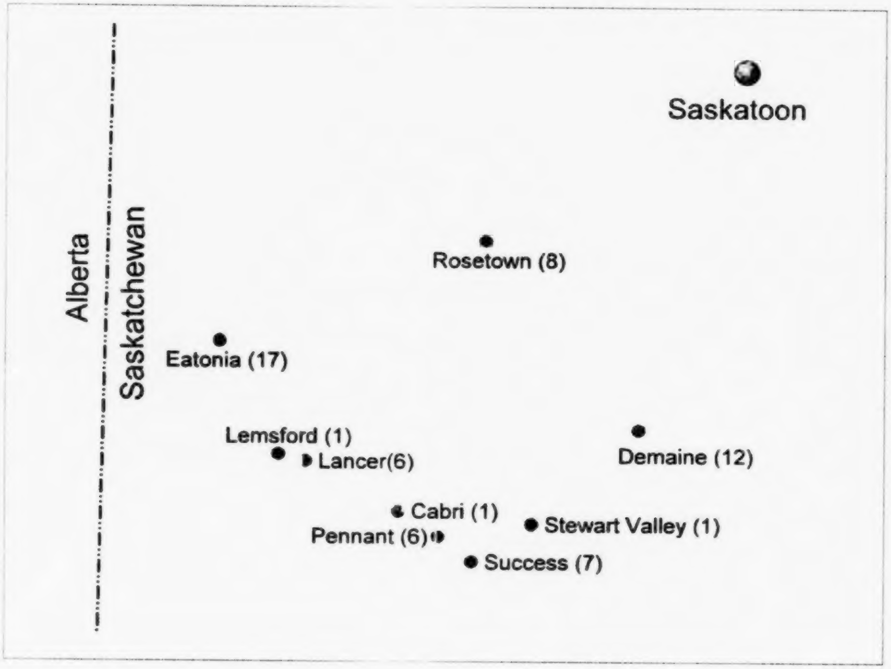
Table 3. Effect of cultivar and seed treatment on chickpea root rot diseases in west-central Saskatchewan in 2000.

	NO. FIELDS SURVEYED	ROOT ROT DISEASE[1]			
		INCIDENCE (%)		SEVERITY (0-4)	
Cultivar					
CDC Yuma	2	32.5	(30.0 - 35.0)	0.5	(0.5 - 0.6)
CDC Anna	1	30		0.5	
Myles	10	29	(0 - 60.0)	0.5	(0 - 0.8)
Evans	5	16	(0 - 30.0)	0.2	(0 - 0.5)
Sanford	18	12.8	(0 - 45.0)	0.2	(0 - 0.8)
B90	3	5	(0 - 15.0)	0.1	(0 - 0.4)
Dwelley	18	3.9	(0 - 20.0)	0.1	(0 - 0.4)
CDC Xena	2	0		0.0	
Seed treatment[2]					
Non-treated	7	29.3	(0 - 60.0)	0.5	(0 - 1.0)
Crown/Apron	45	11.8	(0 - 45.0)	0.2	(0 - 0.9)
Vitaflo 280/Apron	5	9.0	(0 - 25.0)	0.1	(0 - 0.4)
Apron	2	0		0.0	

[1] Root rot diseases include fusarium, pythium and rhizoctonia root rots. Means are presented with their ranges in parentheses under each category.

[2] The seed treatments were applied by the commercial seed suppliers as Crown at 300 mL + Apron at 16 mL/100 kg seed, Vitaflo 280 at 260 mL + Apron at 16 mL/100 kg seed, and Apron alone at 16 mL/100 kg seed.

Figure 1. Distribution of surveyed chickpea fields in west-central Saskatchewan in 2000. Numbers in parentheses indicate the number of fields surveyed near each town.


Saskatoon
Alberta
Saskatchewan
Rosetown (8)
Eatonia (17)
Lemsford (1)
Lancer(6)
Demaine (12)
Cabri (1)
Stewart Valley (1)
Pennant (6)
Success (7)

CROP: Field bean

LOCATION: Manitoba

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TITLE: DISEASES OF FIELD BEAN IN MANITOBA IN 2000

METHODS: Crops of field bean were surveyed for root diseases at 33 different locations and for foliar diseases at 36 locations in Manitoba. The survey for root diseases was conducted in the first week of July when plants were at the second to third trifoliate stages, and for foliar diseases was conducted in the last week of August when the plants were at the late pod-filling to early maturity stages. The crops surveyed were chosen at random from regions in southeast and south-central Manitoba, where most field bean is grown. Ten plants were sampled at each of three random sites for each crop surveyed. Diseases were identified by symptoms. The severity of root diseases was estimated using a scale of 0 (no disease) to 9 (whole roots/lower stem severely diseased). Five to ten roots with disease symptoms per field were collected for isolation of fungi in the laboratory in order to confirm the visual assessment. Severity of foliar diseases was estimated using a scale of 0 (no disease) to 5 (whole plants severely diseased). White mould was rated as a percentage of plants infected.

RESULTS AND COMMENTS: Root rots were observed in all 33 fields surveyed and a total of four diseases was recorded (Table 1). Of the four diseases, rhizoctonia root rot (*Rhizoctonia solani*) and fusarium root rot (*Fusarium solani* f. sp. *pisi*) were the most prevalent, and were observed in 24 and 21 of the 33 fields surveyed, respectively. The mean severity for rhizoctonia root rot was 1.9 and for fusarium root rot was 1.8 on the 0-9 scale. Severe infection by either disease was not observed. Other root diseases including pythium root rot (*Pythium* spp.) and aphanomyces root rot (*Aphanomyces euteiches*) were minor and each was observed in only three crops.

Four foliar diseases were observed in the 36 fields surveyed (Table 2). Bacterial blights (common bacterial blight *(Xanthomonas campestris* pv.*phaseoli*), halo blight *(Pseudomonas syringae* pv. *phaseolicola)* and bacterial brown spot *(Pseudomonas syringae* pv. *syringae*) were observed in all 36 fields surveyed and were the most severe diseases of field bean in Manitoba in 2000. Yield reduction due to bacterial blights was estimated to be at least 10%. Anthracnose (*Colletotrichum lindemuthianum*) was observed in eight crops, but the intensity was generally low for the infested crops. Other diseases including white mold (*Sclerotinia sclerotiorum*) and rust *(Uromyces appendiculatus)* were observed in two and one crops, respectively. These diseases did not appear to cause significant damage to the field bean crops.

Table 1. Intensity of root diseases in 33 crops of field bean in Manitoba in 2000.

DISEASE	NO. FIELDS AFFECTED	DISEASE INTENSITY IN AFFECTED FIELDS[1]	
		Mean	Range
Rhizoctonia root rot	24	1.9	0.8-3.6
Fusarium root rot	21	1.8	0.8-3.6
Pythium root rot	3	3.7	1.4-7.9
Aphanomyces root rot	3	4.4	1.7-7.9

[1] Disease intensity was rated on a scale of 0 (no disease) to 9 (whole roots severely diseased).

Table 2. Intensity of bean diseases in 36 crops of field bean in Manitoba in 2000.

DISEASE	NO. FIELDS AFFECTED	DISEASE INTENSITY IN AFFECTED FIELDS[1]	
		Mean	Range
Bacterial blights	36	2.8	1.5-4.5
Anthracnose	8	2.4	1.0-3.5
White mold	2	10.0	10.0
Rust	1	1.5	1.5

[1] White mold was rated as percent plants infected; other diseases were rated on a scale of 0 (no disease) to 5 (whole plant severely diseased).

CROP: Field pea

LOCATION: Manitoba

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TITLE: DISEASES OF FIELD PEA IN MANITOBA IN 2000

METHODS: Crops of field pea were surveyed for foliar diseases at 23 different locations in Manitoba. The survey was conducted in the third week of July when the plants were at the pod-fill to early maturity stages. The crops surveyed were chosen at random from regions in south-west and south-central Manitoba, where most field pea is grown. Ten plants were sampled at each of three random sites for each crop surveyed. Diseases were identified by symptoms. Fusarium wilt and sclerotinia stem rot were rated as percentage of plants infected. The severity of other diseases observed was estimated using a scale of 0 (no disease) to 9 (whole plants severely diseased).

RESULTS AND COMMENTS: Six diseases were observed in the 23 fields surveyed (Table 1). Mycosphaerella blight (*Mycosphaerella pinodes*) was the most prevalent disease, observed in all fields surveyed. However, severe infection (Intensity >6.0) by mycosphaerella blight was observed in only two crops. Average yield reduction was estimated at less than 10%. Fusarium wilt (*Fusarium oxysporum* f. sp. *pisi*) was observed in 16 of the 23 fields surveyed, and was the second most prevalent disease. The mean incidence of fusarium wilt was less than 4% for all infested crops and the disease did not appear to cause significant yield reduction. Sclerotinia stem rot (*Sclerotinia sclerotiorum*) was observed in seven fields and infection ranged from 10 to 70%. The yield reduction in sclerotinia stem rot-infested crops was estimated at more than 10% on average. Other diseases including powdery mildew (*Erysiphe pisi*), bacterial blight (*Pseudomonas syringae* pv. *pisi*), and anthracnose (*Colletotrichum pisi*) were observed in two, one, and one of the crops, respectively. Severity of these diseases was low and did not appear to cause significant damage to the pea crops.

Powdery mildew was the most prevalent disease on pea in Manitoba in previous years. The lower level of powdery mildew in 2000 may be due to early seeding (before May 10), the greater use of resistant cultivars, and unfavorable weather conditions, or a combination of these factors.

Table 1. Intensity of foliar diseases in 23 crops of field pea in Manitoba in 2000.

DISEASE	NO. FIELDS AFFECTED	DISEASE INTENSITY IN AFFECTED FIELDS[1]	
		Mean	Range
Mycosphaerella blight	23	3.9	1.5-8.5
Fusarium wilt	16	3.1	2.0-4.0
Sclerotinia stem rot	7	24.3	10.0-70.0
Powdery mildew	2	2.8	1.0-4.5
Bacterial blight	1	3.0	3.0
Anthracnose	1	3	3

[1] Fusarium wilt and sclerotinia stem rot was rated as percent plants infected; other diseases were rated on a scale of 0 (no disease) to 9 (whole plant severely diseased).

CROP: Flax

LOCATION: Manitoba and Saskatchewan

NAME AND AGENCY:

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TITLE: DISEASES OF FLAX IN MANITOBA AND SASKATCHEWAN IN 2000

METHODS: A total of 74 flax crops in southern Manitoba and 48 in central and eastern Saskatchewan was surveyed in 2000. Forty-five crops were surveyed during the third week in July, and 77 crops during the third and fourth week in August. Solin flax with low linolenic acid and yellow seed colour was distinguished in 10% of the crops surveyed in August, but linseed constituted 90% of the crops surveyed. Crops surveyed were selected at random along preplanned routes in the major areas of flax production. Each crop was sampled by two persons walking 100 m in opposite directions in the field following an "M" pattern. Diseases were identified by symptoms and the incidence and severity of each disease were recorded. Stand and vigour were rated on a scale of 1 to 5 (I = very good, and 5 = very poor).

In addition, 30 samples of flax plants were submitted for analysis to the Manitoba Agriculture and Food Crop Diagnostic Centre by agricultural representatives and growers.

RESULTS AND COMMENTS: Seventy-five percent of the flax crops surveyed in 2000 were rated very good for stand establishment, and 63% had very good vigour. Thirty-two percent of the crops surveyed were seeded late and were expected to be late for maturity and harvesting. Growing conditions were generally good except for abnormally wet conditions towards the end of August in southern Manitoba and eastern Saskatchewan, which resulted in heavy lodging in several crops and noticeable amounts of dark brown and black seed.

Pasmo (*Septoria linicola*) was observed in 86% of the crops surveyed (Table 1). The prevalence and severity of pasmo in 2000 were similar to 1999 but higher than in previous years (1, 2), due perhaps to the relatively wet weather during the second half of the growing season. In the infested crops, pasmo incidence ranged from 1% to 100% infected plants, and severity ranged from 1% to >60% stem and leaf area affected. Twenty-six percent of the crops had >60% plants severely infected with pasmo.

Heavily lodged plants were observed in 28% of crops, and traces to 80% of the plant area affected by *Alternaria* and other saprophytic fungi were observed in lodged crops. Frequent visits to some flax fields in southern Manitoba towards the end of the season revealed higher levels of pasmo and *Alternaria* infections than those observed in August.

Flax stems infected by *Sclerotinia sclerotiorum* were observed in only three crops in 2000 in comparison to 14 crops in 1999 (1). Typical symptoms were white bleached and shredded stems and tiny cylindrical sclerotia inside infected stems. The *Sclerotinia* infections were only observed in heavily lodged flax.

Root infections and fusarium wilt (*Fusarium oxysporum f.sp. lini*) were observed in 54% of flax crops in 2000 in comparison to 93% and 86% of crops, respectively in 1999 and 1998 (1, 2). Incidence of fusarium wilt ranged from trace to 10%, except for a few crops in Manitoba and Saskatchewan where fusarium wilt incidence ranged from 20-30%.

Powdery mildew (*Oidium lini*) was observed again in 2000 in 10% of the crops surveyed with a severity range from trace to 40% leaf area affected. The incidence and severity of this disease were low in 2000 in spite of the sharp increases in the last three years since it was first reported in western Canada (1, 2). Most of the flax crops affected by powdery mildew were near Regina, Grenfell, Melfort, and Yorkton in Saskatchewan, and near Portage la Prairie and south central areas in Manitoba.

Traces to 5% affected plants were observed with aster yellows (phytoplasma) in 11% of the flax crops in 2000. The incidence and severity of aster yellows in 2000 were lower than in 1999 when the severity of this disease was higher than in any of the last 10 years (1).

Rust (*Melampsora lini*) was not observed in any of the 122 crops surveyed, nor in the rust-differential flax nurseries planted at Morden and at Portage la Prairie.

Of the 30 flax samples submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre, one was affected by pasmo, two affected by fusarium wilt/root rot (*Fusarium oxysporum f.sp. lini* and other *Fusarium* spp.), one affected by seedling blight *(Rhizoctonia spp*), and two with black seed (*Alternaria spp.)*. In addition to diseases, 16 samples were affected by herbicide injury, two samples by nutrient deficiencies, and six samples by various environmental factors.

ACKNOWLEDGEMENTS: The assistance of Lawrence Wiebe and Maurice Penner in conducting this survey is gratefully acknowledged.

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Table 1. Incidence and severity of fusarium wilt, pasmo, and powdery mildew in 122 crops of flax in southern Manitoba, and central and eastern Saskatchewan in 2000.

CROPS AFFECTED BY											
FUSARIUM WILT				PASMO				POWDERY MILDEW			
CROPS		DISEASE		CROPS		DISEASE		CROPS		DISEASE	
No.	%	Incid.[1]	Sever[2]	No.	%	Incid.[1]	Sever[2]	No.	%	Incid.	Sever[2]
51	42	0	0	9	7	0	0	110	90	0	0
31	25	1 - 5	1 - 5	37	30	1 - 10	1 - 5	7	6	1 - 10	1 - 5
28	23	5 - 20	5 - 10	26	21	10 - 30	5 - 10	1	1	10 - 30	5 - 10
9	7	20-40	10 - 20	24	20	30-60	10 - 20	3	3	30-60	10 - 20
3	3	>40	10-40	26	21	>60	10-50	1	1	>60	10-50

[1] Incidence = Percentage of infected plants in each field.

[2] Severity = Percentage of roots affected by fusarium wilt, stems affected by pasmo, and leaves affected by powdery mildew.

CROP: Lentil

LOCATION: Saskatchewan

NAMES AND AGENCIES:

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TITLE: SEED-BORNE PATHOGENS OF LENTIL IN SASKATCHEWAN IN 2000

METHODS: The results of agar plate tests conducted by four Saskatchewan companies on seed samples from the 2000 crop were summarized. The tests were conducted mainly to detect the pathogens causing ascochyta blight *(Didymella [Ascochyta] lentis*), anthracnose *(Colletotrichum truncatum*), grey mould and seedling blight *(Botrytis cinerea*) and sclerotinia stem and pod rot *(Sclerotinia sclerotiorum*). Not all samples were tested for *Colletotrichum*, *Botrytis* and *Sclerotinia* but all were tested for *Ascochyta*. Figures for *A. lentis* and *B. cinerea* were classified according to crop districts [CD] of Saskatchewan (Fig. 1). However, this was not done for *C. truncatum* and *S. sclerotiorum* because infection levels are generally so low that comparisons of means would be valueless.

It was unknown which of the seed samples came from lentil crops that had been treated with registered fungicides. Bravo (a.i. chlorothalonil) is widely used as a foliar protectant against ascochyta blight and anthracnose, while Crown (a.i. thiabendazole + carbathiin) is often used as a seed treatment against seed-borne *Ascochyta* and *Botrytis*. This was the first year in which the use of new ascochyta-resistant lentil cultivars was widespread. Therefore, mean provincial infection levels for ascochyta in seed were calculated separately for resistant and susceptible cultivars, when the information was available.

RESULTS AND COMMENTS: In most areas of Saskatchewan the growing season started with relatively dry conditions that resulted in early completion of seeding in May. From June to early August rainfall amounts varied from about 50% to 200% of normal in different crop districts, with the wettest conditions generally in the northeast, southeast and south central areas. In late August good harvest weather prevailed throughout the province, but in early September rain and warm humid weather caused deterioration of crop quality in many areas. The average provincial lentil yield was similar to the 10-year average, but about 8% below that in 1999.

By mid-December nearly 1200 lentil seed samples had been tested by the four companies. The 10% increase over 1999 in lentil samples tested (1) was probably due to a substantial increase in acreage. Mean levels of seed-borne *Ascochyta* varied among crop districts (Table 1), but were not necessarily highest in districts which received the highest total rainfall in June and July. The highest value was 41% in a sample from CD 2A.

On a provincial basis the mean level of seed infection was 2.5%, while 34% of samples tested 0% ascochyta. The corresponding figures for 1999 were 3.1% and 17%. While this indicates a reduction in levels of ascochyta blight from 1999 to 2000, the reason is probably related more to the change in lentil cultivars than to weather. Approximately 25% of samples tested in 2000 were new ascochyta-resistant cultivars [CDC Glamis, CDC Grandora, CDC Milestone, CDC Redcap, CDC Redwing, CDC Robin, CDC

Sovereign, CDC Vantage, 997-5R]. The mean *Ascochyta* seed infection in these cultivars was 0.4%. About 50% of all samples tested were known susceptible cultivars [CDC Richlea, Crimson, Eston, French Green and Laird]. In these, the mean *Ascochyta* seed infection was 3.3%. In the remaining samples, for which no cultivar was specified, but which were probably mostly susceptible types, the mean *Ascochyta* seed infection was 2.9%. The values of 3.3% and 2.9% are probably the most appropriate to compare with figures for the previous 3 years (1,2,3).

Botrytis was detected in 80% of all samples tested. The corresponding percentages were 69% [erroneously reported as 31% in reference 1) in 1999 and 73% in 1998 (2). The mean infection level was 2.3%, compared with 0.7% in 1999 and 0.3% in 1998. Thus, there was a substantial increase in prevalence and incidence of seed infection compared with the two previous years. The highest level of seed infection in 2000 was 19.5%.

Colletotrichum truncatum, which is not a highly seed-borne pathogen, was detected in 7.8% of the samples tested, slightly lower than in the past several years. Most records were from CD 2B, 3A-N, 3B-N and 6B; however other records from CD 2A, 3A-S, 3B-S, 5A, 5B, 6A, 8A and 9A confirm that anthracnose has now spread to all major areas of lentil production in Saskatchewan. The highest level of seed infection detected in 2000 was 5.0%.

As in 1999 (1), *S. sclerotiorum* was commonly isolated from lentil seed but at low levels. This probably reflects the cool wet weather in many areas in July and an increasing number of broad-leaved crops in rotations in the major lentil-producing regions.

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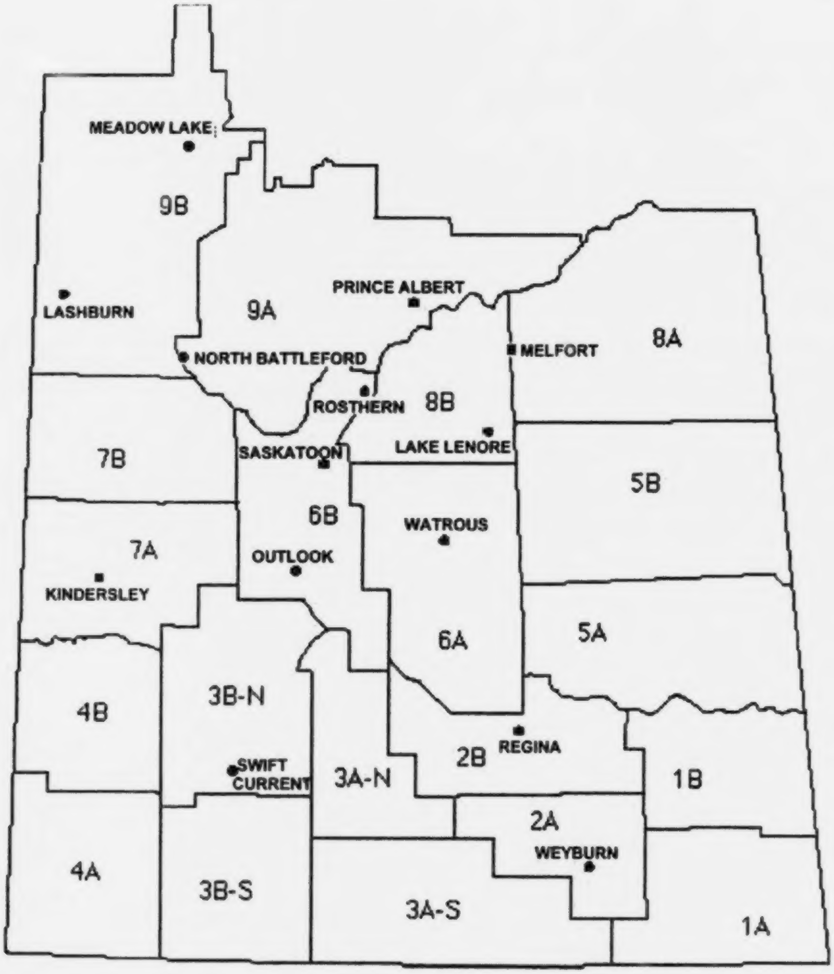
(http://res2.agr.ca./london/pmrc/)

Table 1. Number of lentil seed samples tested from August to mid-December, 2000 by four commercial companies and mean percent infection with *Ascochyta* and *Botrytis* in relation to Saskatchewan Crop Districts.

Crop District	***ASCOCHYTA***			***BOTRYTIS***		
	No. of samples tested	**Mean % infection**	**% samples with 0% infection**	**No. of samples tested**	**Mean % infection**	**% samples with 0% infection**
1A	1	0	100	0	-	-
1B	3	0	100	3	7.1	0
2A	116	2.4	54	97	3.5	13
2B	258	2.3	43	234	2.3	16
3AN	54	3.6	23	52	2.2	8
3AS	59	2.3	26	55	2.4	15
3BN	167	2.8	34	157	1.7	34
3BS	53	4.5	22	49	1.4	25
4A	17	1.4	13	15	0.2	29
4B	14	0.3	77	12	<0.1	92
5A	33	2.6	0	33	3.9	14
5B	11	0.4	89	11	1.2	33
6A	83	2.3	31	80	3.2	9
6B	119	2.3	23	113	3.6	11
7A	145	2.6	20	136	1.1	33
7B	14	2.4	7	13	2.0	23
8A	3	0	100	2	3.3	0
8B	1	0	100	1	2.5	0
9A	5	5.1	75	3	2.0	0
9B	3	0.4	n/a	2	5.0	n/a
TOTAL	1179	2.5	34	1083	2.3	20

[1] n/a = not available

Figure 1. Map of crop districts in Saskatchewan.


MEADOW LAKE
9B
PRINCE ALBERT
LASHBURN
9A
MELFORT
8A
NORTH BATTLEFORD
ROSTHERN
8B
SASKATOON
LAKE LENORE
7B
5B
6B
WATROUS
7A
OUTLOOK
KINDERSLEY
6A
5A
4B
3B-N
2B
REGINA
SWIFT CURRENT
3A-N
1B
2A
WEYBURN
4A
3B-S
3A-S
1A

CROP: Pea

LOCATION: Saskatchewan

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TITLE: SEED-BORNE PATHOGENS OF PEA IN SASKATCHEWAN IN 2000

METHODS: The results of agar plate tests conducted by four Saskatchewan companies on seed samples from the 2000 crop were summarized. The tests were conducted mainly to detect the pathogens causing ascochyta blights (*Mycosphaerella* [*Ascochyta*] *pinodes* and *A. pisi*), botrytis blight (*Botrytis cinerea*) and sclerotinia stem and pod rot (*Sclerotinia sclerotiorum*). Not all samples were tested for *Botrytis* and *Sclerotinia* but all were tested for the ascochyta blight pathogens. Figures for *Ascochyta* spp. and *B. cinerea* were classified according to crop districts [CD] of Saskatchewan (1). However, this was not done for *S. sclerotiorum* because infection levels are generally so low that comparisons of means would be valueless.

RESULTS AND COMMENTS: In most areas of Saskatchewan the growing season started with relatively dry conditions that resulted in early completion of seeding in May. From June to early August rainfall amounts varied from about 50% to 200% of normal in different crop districts, with the wettest conditions generally in the northeast, southeast and south central areas. Frost in a large area of east-central Saskatchewan on July 16 caused severe damage and yield loss in many pea crops. In late August good harvest weather prevailed throughout the province, but in early September rain and warm humid weather caused deterioration of crop quality in areas where harvest was not complete. The average provincial pea yield was 10% greater than the 10-year average, but about 17% below the exceptional mean yield of 1999 (2).

By mid-December nearly 500 pea seed samples had been tested by the four companies. Mean levels of seed-borne *Ascochyta* spp. varied among crop districts (Table 1), with the highest levels in the northern crop districts (CD 8 and 9) where there is the longest history of pea growing. The maximum recorded value was 24.5% in two samples, one from CD 6A and one from CD 8B.

On a provincial basis mean seed infection was 3.1% and the percentage of samples in which no infection was detected was 24%. These values were 25% lower and 40% higher, respectively, than corresponding values for 1999 (2). However, mean provincial seed infection levels were still considerably higher than those recorded 1998 and 1997 (3,4).

Botrytis was detected in 28% of pea samples tested compared with 35% in 1999 (2). However, the mean seed infection level was 0.3% for both years. The highest mean seed infection levels were in CD 2B, 7B, 8A, 8B and 9B (Table 1) and the highest individual value recorded was 5% in CD 8B. Generally *Botrytis* was not a problem on pea crops in Saskatchewan in 2000. *Sclerotinia sclerotiorum* was isolated from less than 30% of pea seed samples in 2000 and, in these, most commonly at a level of 0.5 or 1.0%.

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Table 1. Number of pea seed samples tested from August to mid-December, 2000 by four commercial companies and mean percent infection with *Ascochyta* and *Botrytis* in relation to Saskatchewan Crop Districts.

Crop District	***ASCOCHYTA***			***BOTRYTIS***		
	No. of samples tested	**Mean % infection**	**% samples with 0% infection**	**No. of samples tested**	**Mean % infection**	**% samples with 0% infection**
1A	5	0.6	60	3	0	100
1B	4	3.5	25	2	0.5	50
2A	9	10	38	8	0.1	8.8
2B	37	2.1	22	27	0.5	60
3AN	6	2.1	0	6	0.1	80
3AS	33	1.8	31	23	0.1	83
3BN	34	2.3	44	32	0.2	73
3BS	13	0.3	82	10	0	100
4A	4	0.4	75	4	0.1	67
4B	8	0	100	7	0.1	86
5A	16	1.4	40	7	0	100
5B	30	1.8	17	25	0.1	88
6A	54	2.7	10	45	0.2	67
6B	45	2.9	12	28	0.3	70
7A	29	1.1	39	20	0.1	85
7B	18	3.7	6	16	0.4	60
8A	32	4.4	18	23	0.5	71
8B	51	7.3	3	20	0.7	47
9A	31	4.9	8	18	0.3	50
9B	25	5.9	0	21	0.5	56
TOTAL	484	3.1	24	343	0.3	72

CROP: Soybean

LOCATION: Ontario

NAME AND AGENCY:

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TITLE: DISEASES OF SOYBEAN IN ONTARIO AND ESTIMATED YIELD LOSSES, 1994,1996-2000

INTRODUCTION: Soybean production has increased dramatically in Ontario during the past 30 years. The increase has occurred in new production areas in central and eastern Ontario in addition to more frequent cropping of soybean in southwestern Ontario. Cultural practices such as tillage have also changed during recent years. Increased production has contributed to an increase in the frequency and severity of soybean diseases. Reduced tillage may be economical but may contribute to increased disease severity by reducing soil temperatures and increasing soil moisture at planting.

There has been no general disease loss survey of soybean in Ontario. Such a survey would be difficult with over 800 thousand ha of soybean in Ontario in 2000. However, with large acreage crops, it is useful to estimate losses for the following reasons: 1) to document the presence of diseases, 2) to priorize research on disease management and 3) to provide direction to public and private soybean breeders in developing disease resistance. Therefore, disease loss estimates were developed as a guide to those interested in Ontario soybean diseases.

METHODS: Disease loss estimates were derived from non-formal surveys, grower samples submitted for diagnosis, discussion with extension agents, crop consultants, growers and provincial authorities. Observations of soybean diseases are made during the annual field plot tour of the Ontario Oil and Protein Seed Crop Committee which involves visits in all soybean production areas of Ontario. The losses should be considered as only very general conservative estimates. It should also be noted that although some mean Ontario values are minimal, losses can be severe on an individual field, farm or region basis.

RESULTS AND COMMENTS: Disease loss estimates for 1994 (Wrather et al., 1997) and 1996 to 2000 are presented in Table 1. Bacterial diseases (bacterial blight [*Pseudomonas savastanoi* pv. *glycinea*] and wildfire [*Pseudomonas syringae* pv. *tabaci*]) are found in most soybean production areas but are not considered to cause economic losses. Diseases caused by fungi are commonly observed and can be severe. Seedling diseases caused by *Pythium* sp., *Fusarium* spp., *Rhizoctonia solani*, *Phomopsis* sp. and *Phytophthora sojae* occur in cool wet weather. The incidence of each pathogen may vary with soil type and temperature. In 2000, seedling disease was severe because of cool, wet weather. Sclerotinia stem rot (*Sclerotinia sclerotiorum*) has been a major problem in recent years in Ontario. The severity of sclerotinia stem rot increases during cool, wet weather in the period from pod fill to maturity and therefore the severity changes annually. The consistently important disease, phytophthora root rot is caused by *Phytophthora sojae*. Although soybean cultivars in Ontario are tolerant or resistant to this disease, isolates of the fungus with novel patterns of virulence continue to develop. The fungus is found in all soil types but most losses occur on poorly drained, fine textured soil. Sudden death syndrome (SDS) (*Fusarium solani* f. sp. *glycinea*) has increased in frequency since symptoms of the disease were first noted in 1993 (Anderson and Tenuta, 1998). The disease is found on sandy loam soils in association with infestations of soybean cyst nematode. The disease has become permanently established in some fields and losses occur each year. Fusarium root rot and wilt (*Fusarium solani, F. oxysporum*) has increased in severity over the survey period. The disease occurs in hot weather following periods of heavy rain prior to pod set. It is found in all growing regions and is common in Eastern Ontario.

Rhizoctonia root rot (*Rhizoctonia solani*) may occur at all stages of plant growth but it is frequently observed in July during flowering. A typical zonate canker with alternating dark and light bands develops on the lower stem. The disease is frequently associated with high organic matter and hot conditions following high rainfall. Northern stem canker (*Diaporthe phaseolorum* var. *caulivora*) has become more common recently. The incidence of this disease is higher under minimum tillage and may affect soybean prior to flowering under hot humid conditions. Phomopsis seed rot (*Phomopsis longicola*) and pod and stem blight (*Diaporthe phaseolorum* var. *sojae*) are very weather dependent. Seed rot occurs more frequently with warm wet weather prior to harvest. Charcoal rot (*Macrophomina phaseolina*) and brown stem rot (*Phialophora gregata*) appear to be increasing in importance, especially under hot dry conditions in August. Brown spot (*Septoria glycines*) downy mildew (*Peronospora manchurica*), purple stain (*Cercospora kikuchii*), powdery mildew (*Microsphaera diffusa*) and frogeye leafspot (*Cercospora sojina*) can be observed in most seasons but rarely cause yield problems. Brown spot is becoming more severe especially if plants are under moisture or nutritional stress.

Viruses (soybean mosaic virus, tobacco ringspot virus) seldom cause significant yield losses in growers' fields; however, disease symptoms such as pod abortion and green stem are becoming more common. In 2000 random samples of green stem plants tested for bean pod mottle virus proved negative.

The single most important pathogen of soybean in Ontario is soybean cyst nematode (*Heterodera glycines*) (SCN). Since it was first found in 1987 (Anderson et al., 1988), the nematode has increased in distribution and abundance. Fortunately, SCN resistant cultivars are available and yield losses are beginning to decline in areas with a history of SCN. The nematode continues to spread to new areas to the east and it is probable that SCN will remain the most important pathogen of soybean in Ontario for a number of years. Yield losses of 20-40% in individual fields have been documented. Foliar symptoms may or may not be evident in infested fields.

CONCLUSIONS: We expect soybean disease pressure to continue to increase in Ontario with decreased crop rotation. SCN will increase in importance as the pest spreads to new areas of the province. Although resistant cultivars reduce yield losses, soil sampling and crop inspection are needed to identify the pest. The increase in pre and post emergent seedling diseases may be reduced in the future with an increased emphasis by industry on new seed treatments. The need for effective broad spectrum seed treatments is still high.

Further research needs to be done on the influence of reduced tillage practices on disease incidence. In Ontario, residue-borne soybean diseases are increasing as a result of adoption by growers of good conservation soil management. A balance between soil management practices and disease control must be found. Many early-season diseases are more severe when seed vigour is low. Both public and private soybean breeders need to continue to develop cultivars with high seedling vigour and new sources of resistance to the important soybean diseases in Ontario.

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Table 1. Yield loss estimates (%) caused by soybean diseases in 1994, 1996-2000 in Ontario.

	DISEASES	1994	1996	1997	1998	1999	2000
	Bacteria						
1	Bacterial blight, Wildfire	0	0	tr	0	tr	tr
	Fungi						
1	Seedling diseases[1]	0.5	0.5	0.6	0.7	0.7	1
2	Sclerotinia stem rot	0.5	0.5	0.4	0.4	0.3	0.9
3	Phytophthora root rot	0.5	0.5	0.5	0.5	0.5	0.8
4	Sudden Death Syndrome	0	0	0.02	0.06	0.07	0.3
5	Rhizoctonia root rot	0.05	0	0.15	0.25	0.03	0.3
6	Fusarium root rot	0	0.03	0.05	0.25	0.3	0.3
7	Stem canker	0.05	0.4	0.06	0.1	0.3	0.25
8	Phomopsis seed rot	0.05	0.2	0.1	0.05	0.05	0.2
9	Pod and Stem blight	0	0	0.1	0.05	0.05	0.15
10	Charcoal rot	0.03	0.03	0.08	0.1	0.2	0.15
11	Brown stem rot	0	0.03	0.06	0.1	0.2	0.15
12	Brown spot	0.03	0.04	0.03	0.03	0.05	0.08
13	Downy mildew	0.02	0.02	0.02	0.01	0.01	0.01
14	Purple stain	0	0	0	0	0	0.01
15	Powdery mildew	0	tr	0	tr	tr	0
16	Frogeye leaf spot	0	0	0	0	0	0
17	Rhizoctonia aerial blight	0	0	0	0	0	0
18	Southern stem canker	0	0	0	0	0	0
	Viruses						
1	SMV, TRSV	0	0	0	0	0.02	0.01
	Nematodes						
1	Soybean cyst nematode	0.8	1.2	2.9	3.25	3	3
2	Root knot and other nematodes	0	0	0	0	0	0
	Total yield loss to disease	2.53%	3.45%	5.07%	5.85%	5.48%	7.61%

[1] Seedling diseases due to *Rhizoctonia, Pythium, Fusarium, Phytophthora* and *Phomopsis*.

CROP: Sugar beet

LOCATION: Southern Alberta

NAME AND AGENCY:

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TITLE: SURVEY OF DAMPING-OFF DISEASES OF SUGAR BEET IN SOUTHERN ALBERTA in 2000

INTRODUCTION: With a processing plant in Taber, southern Alberta is the only area of sugar beet production in Canada. The area contracted for sugar beet production has increased from 12,150 ha in 1986 to 18,220 ha in 1999 with root yield reaching 850,000 tonnes in 1999 (Chaudhary 1998). With the expansion of the sugar beet processing plant in 1998, sugar beet production is likely to expand further in this area. Sugar beet is an important crop for rotation with cereals and legumes and for crop diversification in western Canada. Nevertheless, it is highly susceptible to damping-off pathogens such as *Pythium* sp. "group G", which is widespread in southern Alberta (Huang et al. 1992). A survey of damping-off diseases of sugar beet in southern Alberta was conducted during the growing season of 2000.

METHODS: Twenty-six crops of sugar beet were surveyed for damping-off diseases between May 16 and June 7. The survey covered the sugar beet growing area of southern Alberta, from Picture Butte to Bow Island and south to Foremost. Emergence within a field was estimated by counting the number of seedlings at 9 sites. The sites were located in three rows, randomly selected, approximately 30 m apart from one another. Each row had three sites, 4.5 m in length, that were 20 m apart in the row. Due to the precision seeding used in commercial production of sugar beet in Alberta (one seed per 15 cm), a 4.5 m site consisted of 30 plants. Percent emergence was calculated by dividing the number of seedlings by 30 and multiplying by 100. Soil samples were collected from the surveyed fields and tested for incidence of damping-off pathogens of sugar beet in the growth chamber. Three pots filled with soil from each surveyed crop were planted with seeds of sugar beet c.v. HM Bergen (five seeds per pot). The pots were watered and put in propagator trays to produce high moisture condition for the development of the disease. The propagator trays were kept in a growth cabinet under controlled light and temperature conditions (16 h day/8 h night; 20°C/15°C). The number of plants emerged was recorded after 14 days and the percent emergence was calculated for each crop. Non-germinated seeds were collected, washed in sterile water, surface sterilized in 70% ethanol for 2 min, plated on potato dextrose agar (PDA) and incubated for 3 to 5 days. Fungi isolated from the seeds were purified on PDA and the genus of each fungus isolated was determined based on morphological characteristics.

RESULTS and DISCUSSION: The field survey showed that seedling emergence varied among crops. Of the 26 crops surveyed, seedling emergence was less than 50% in four crops, 50 to 65% in 12 crops, 66 to 80% in seven crops and over 80% in three crops (Table 1). The four crops that showed emergence lower than 50% were surveyed on May 16 at which time seedling emergence may not have been complete, due to the long emergence period of sugar beet. Early June is therefore the best period to assess seedling emergence in sugar beet seeds. The relationship between seedling emergence in the field and disease incidence was assessed by testing the soils collected in growth chamber experiments.

Results of soil testing showed that seedling emergence in soil collected from each field surveyed ranged from 26 to 94%. Severe disease was observed in six soils (emergence less than 60%), while 11 soils had low disease (emergence of 61-80%) and nine soils had no disease (emergence over 80%) (data not shown). Severely diseased crops therefore account for 23 % of the fields surveyed. When comparing indoor and outdoor seedling emergence, four of the soils rated as having severe disease incidence had emergence in the field around 63% (Table 1). One of the soils with 34% seedling emergence in the indoor experiment also showed very low emergence in the field (36%) (Table 1). Another soil that showed low emergence in the indoor experiment (46%) had an emergence level of 72% in the field (Table 1). *Pythium* sp., likely *Pythium ultimum* "group G" that is widespread in sugar beet in southern Alberta (H.C. Huang, unpublished data), was isolated from non-germinated seeds from five of the fields rated as severely diseased. The fungus *Rhizoctonia solani* was found in two of the crops, with field emergence of 55% and 68%. Both soils had a 74% seedling emergence in the indoor experiment. These data suggest that *Pythium* is the main cause of poor stands of sugar beet in southern Alberta, while *Rhizoctonia* is of minor importance. High disease pressure from a pathogen such as *Pythium* sp. may be due to field history or crop management such as growing sugar beet in rotation with other susceptible host crops, like canola, safflower and dry pea.

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Table 1. Survey of seedling emergence and incidence of pythium damping-off of sugar beet in southern Alberta in 2000.

% EMERGENCE	# OF FIELDS	INCIDENCE OF *PYTHIUM* SP. IN SOIL
81-100	3	0
66-80	7	1
50-65	12	4
< 50	4	1

CROP: Sunflower

LOCATION: Manitoba and Saskatchewan

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TITLE: DISEASES OF SUNFLOWER IN MANITOBA IN 2000

METHODS: Forty-nine sunflower crops in southern Manitoba and three crops in southeastern Saskatchewan were surveyed in 2000. Ninety percent of the crops were confectionery hybrids and 10% were oilseed hybrids. Eight crops were surveyed during the last week of July, and 44 crops during the last week of August. Crops were surveyed along preplanned routes in the major areas of sunflower production. Each crop was sampled by two persons walking 100 m in opposite directions in the field following an "M" pattern. Diseases were identified by symptoms and the percent incidence of downy mildew (*Plasmopara halstedii*), sclerotinia wilt or head and stem infections (*Sclerotinia sclerotiorum*), rhizopus head rot (*Rhizopus* spp.), and verticillium wilt (*Verticillium dahliae*) were estimated. Disease severity for rust (*Puccinia helianthi*), leaf spots (*Septoria helianthi* and *Alternaria* spp.), powdery mildew (*Erysiphe cichoracearum*) and stem infections (*Phoma* spp. & *Phomopsis* spp.) were measured as percent leaf and stem area infected. A disease index was calculated for each disease in every crop based on disease incidence or disease severity (Table 1).

In addition, 31 samples of sunflower plants were submitted for analysis to the Manitoba Agriculture and Food Crop Diagnostic Centre by agricultural representatives and growers.

RESULTS AND COMMENTS: Seventy percent of the sunflower crops surveyed in 2000 had excellent to good stands and vigour, and only 30% had moderate stands and vigour. Forty-three percent of the crops were seeded late and were expected to mature very late. Growing conditions were generally good except for abnormally wet conditions at maturity time which resulted in high incidence of head rot in several crops. Traces to 5% infestation of sunflower midge (*Contarinia schulzi*) were observed in several crops in the Red River Valley, however, the severity of infestation was extremely low in comparison to the last two years (1, 2).

Sclerotinia diseases were more prevalent in 1999 than in 1998 (1). Sclerotinia wilt/basal stem infection was present in 67% of the crops surveyed, with incidence ranging from trace to 15% infected plants (Table 1). Sclerotinia head rot and mid-stem breakage caused by ascospore infections were present in 65% of the crops surveyed with incidence ranging from trace to 15% infected plants. Visits to some sunflower crops in southern Manitoba towards the end of September revealed higher incidences of head rot than observed during the August survey due, perhaps, to frequent rainfall in late August.

Verticillium wilt was present in 54% of the crops surveyed, with incidence ranging from trace to 30% infected plants (Table 1). The prevalence and incidence of verticillium wilt in 2000 was lower than in 1999 (1) in spite of the increased acreage of confectionery hybrids (90% of total acreage).

Downy mildew was observed in 20% of the crops surveyed but the incidence was very low (trace to 1%) in most crops (Table 1). This is the third consecutive year where dry soil conditions and above normal soil temperatures at the seedling stage may have contributed to low incidence of downy mildew.

Rust was present in 40% of the crops surveyed, with severity ranging from trace to 5% leaf area affected in two-thirds of the crops and up to 60% leaf area affected in one-third of the crops (Table 1). Although the incidence of rust was lower in 2000 than in 1999, the severity in most crops surveyed was higher in 2000 than in 1999 (1, 2).

Traces to 10% leaf area covered by spots caused by *Septoria helianthi* and *Alternaria* spp. were observed in 30% of crops surveyed in 2000. Phoma stem lesions were present in 10% of the crops at trace to 5% stem area affected (Table 1). Trace levels of rhizopus head rot were observed in 10% of the crops. Trace levels of phomopsis stem lesions were observed in a few crops. Traces to 5% leaf area affected by powdery mildew were observed in two crops towards the end of the season.

Of the 31samples submitted to the Manitoba Agriculture and Food Crop Diagnostic Centre, three samples were identified as root rot caused by *Fusarium* spp., two phoma black stem caused by *Phoma* spp., one downy mildew, one aster yellows caused by a phytoplasma, one damping off caused by *Pythium* spp, and one head rot caused by *Sclerotinia sclerotiorum.* In addition to diseases, three samples were affected by insects, four by environmental and physiological factors, and 15 were affected by herbicide injury.

ACKNOWLEDGEMENTS: The assistance of Lawrence Wiebe and Maurice Penner in conducting this survey is gratefully acknowledged.

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Table 1. Prevalence and intensity of diseases and estimated plant stands in sunflower crops in southern Manitoba and southeastern Saskatchewan in 2000.

DISEASE	CROPS AFFECTED		DISEASE/STAND INDEX[1]	
	NO.	%	MEAN	RANGE
Sclerotinia wilt	35	67	1.0	T-2
Sclerotinia head rot/stem rot	34	65	1.1	T-3
Verticillium wilt	28	54	1.2	T-2
Downy mildew	10	20	0.5	T-1
Rust	21	40	1.6	T-4
Septoria leaf spot	15	30	1.0	T-2
Powdery mildew	2	4	0.5	T-1
Phoma stem lesions	4	10	1.0	T-2
Earliness[2]	22	46	1.7	1-4
Stand	15	30	1.4	1-3
Vigour	16	30	1.4	1-3

[1] Disease index is based on a scale of 1 to 5: Trace (T) = < 1%, 1= 1% to 5% disease, 2= 5% to 20% disease, 3= 20% to 40% disease, 4= 40% to 60% disease, and 5= greater than 60% disease levels. Index is based on disease incidence for downy mildew, verticillium wilt, and sclerotinia infections; and on disease severity measured as percent leaf area affected for rust, leaf spots, powdery mildew and phoma stem infections.

[2] Indexes for earliness, stand, and vigour are based on 1-5 scale (1= early/very good and 5= late/very poor). Only 22 crops were late, 15 crops had poor stand, and 16 crops had poor vigour).

Vegetables / Légumes

CROP: Potato

LOCATION: Canada

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TITLE: CROSS-CANADA POTATO LATE BLIGHT SURVEY IN 1999

METHODS: In 1999, 93 samples of potato and tomato suspected of having late blight were received from all provinces. Isolates of *Phytophthora infestans* Mont. (de Bary) were prepared in pure culture and studied for mating type and metalaxyl sensitivity, according to Peters (3) and Peters et al. (4), and glucose phosphate isomerase (*Gpi*) allozyme patterns according to Goodwin et al. (2). Metalaxyl sensitivity was based on 100 µg/ml metalaxyl in the medium, according to Peters (3).

RESULTS: The recovery of active late blight from samples was slightly lower (75%) than in 1998 (81%) (1). About 60%, 57%, 59%, and 89% of the samples received from Newfoundland (NF), Manitoba (MB), Prince Edward Island (PEI), and British Columbia (BC), respectively, were infected with *P. infestans* (Table 1). Only one, two and three samples were sent from New Brunswick (NB), Quebec (PQ) and Ontario (ON), respectively, and they were all infected with late blight. The single samples sent from Alberta (AB) and Nova Scotia (NS) were free of the late blight pathogen. Many of the samples received were also infected by other fungi such as *Verticillium*, *Alternaria*, *Botrytis*, *Fusarium*, or *Rhizoctonia*. The A2 mating type has been found in all Canadian provinces from which infected samples were received, and represented about 71% of the total isolates obtained versus 29% for A1 (Table 1). The A1 mating type was found only in British Columbia. Regarding the genotypes, no US-1 (A1), US-6 (A1), or US-7 (A2) strains were found among the samples received in 1999. On the other hand the Gpi allozyme bandings characterizing genotypes US-10 (MB and PEI), US-11 (BC), and US-8 (BC, MB, NB, NF, ON, PEI, and PQ) were detected.

Among the 267 isolates tested for resistance to metalaxyl, 22% were sensitive (MS), 50% were moderately-resistant (MMR) and 28% were highly-resistant (MHR) (Table 1). In 1999, except in NF, there were more MMR than MS isolates in all provinces, and MHR isolates were found in BC, MB, NB, ON, PEI, and PQ. Among all the A1 isolates, about 1% were MS, 62% were MMR, and 37% were MHR. On the other hand, A2 isolates were about 29% MS, 52% MMR, and 19% MHR. These results clearly indicate an increase in resistance to metalaxyl as compared to 1997 and 1998, especially within US-8 genotype, and a variation in this marker within each genotype.

Thirty eight isolates (19 A1,US-11 and 19 A2,US-8) were tested for their physiologic races. In general, US-8 isolates showed more virulence gene complexity than US-11 isolates. While US-11 isolates could infect on average 2.7 potato differentials, US-8 isolates could infect on average six differentials. In addition, most of the US-11 isolates infected only up to five differentials, except for one isolate that infected seven differentials. In addition, 74% US-11 isolates did not infect more than four differentials. On the other hand, 34% of the US-8 isolates infected all of the ten tested differentials. In addition, only 26% US-8 isolates infected fewer than four differentials.

Thus, variation continues to occur in *P. infestans* populations causing potato late blight in Canada, especially in levels of resistance to metalaxyl. The cause of the changing nature of the pathogen populations and their impact on disease and its control require further study. Also, this year, we received tomato samples from BC, from which the A1 mating type was isolated. Since this plant can be a potential source of inoculum for potato, it is important to monitor tomato late blight in crops and home gardens across Canada.

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4. Peters, R. D., Platt, H. W., and Hall, R. 1998. Long-term survival of *Phytophthora infestans* on liquid media prepared from autoclaved seeds. Can. J. Plant Pathol. 20:165-170.

Table 1. Mating types and metalaxyl resistance of Canadian populations of *Phytophthora infestans* in 1999.

Provinces[1]	PLANT SAMPLES			MATING TYPE[2]		METALAXYL RESPONSE[3]		
	# samples received	# samples blighted	*P. infestans* # isolates tested	A1 (%)	A2 (%)	MS (%)	MMR (%)	MHR (%)
AB	1	0	-	-	-	-	-	-
BC	46	41	102	81	-	1	62	37
				-	19	22	28	50
MB	74	4	103	-	100	35	50	15
NB	1	1	5	-	100	0	60	40
NF	5	3	6	-	100	67	33	0
NS	1	0	-	-	100	-	-	-
ON	3	3	11	-	100	18	64	18
PEI	27	16	37	-	100	33	35	32
PQ	2	2	3	-	100	0	0	100
Total # (%)	93 -	70 (75)	267	-29	-71	-22	-50	-28

[1] Samples were sent from nine Canadian provinces. BC= British Columbia, MB= Manitoba, NB= New Brunswick, NF= Newfoundland, ON= Ontario, PEI= Prince Edward Island, and PQ= Québec. No isolates could be retrieved from samples sent from Alberta (AB) and Nova Scotia (NS).

[2] Mating types were determined after confrontation of isolates with each of the known controls P1023A1 (A1), P1025A1 (A1), P1024B2(A2), and P1031B2(A2) on rye agar medium. Isolates forming oospores with the first two were designated A2, and those forming oospores with the latter two were designated A1.

[3] Resistance to metalaxyl was tested *in vitro* and was based on the relative growth of mycelium at 100 µg/ml *vs* 0 µg/ml of metalaxyl (MTXL) as follows: percent growth (pg) = 100 x (diameter of growth at 100 µg/ml MTXL minus 5 mm) / (diameter of growth at 0 µg/ml MTXL minus 5 mm). Diameter of growth was the mean of six measures. Each isolate was determined as metalaxyl-sensitive (MS) when pg < 10 %, metalaxyl-moderately resistant when 10 % < pg < 60 %, or metalaxyl-highly resistant (MHR) when pg > 60 %. The percentage is calculated separately for each mating type.

[4] 111 pure cultures were also sent for testing.

Fruit, Nuts and Berries, Ornamentals and Turfgrass,/ Fruits, fruits à écale, et baies, plantes ornementales et gazon

CROP: Blueberry (*Vaccinium corymbosum* L.)

LOCATION: British Columbia

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TITLE: **SURVEY OF BLUEBERRY SCORCH VIRUS IN HIGHBUSH BLUEBERRIES IN BRITISH COLUMBIA, 2000**

INTRODUCTION: In June 2000, Blueberry Scorch Virus (BISV) was identified for the first time in British Columbia. The first finding was from mature 'Berkeley' highbush blueberry plants exhibiting extensive blossom blighting and dieback of young leaves and shoots. A week later, the virus was detected in the cultivars 'June' and 'Weymouth' located at a considerable distance from the infected 'Berkeley' field. A survey was undertaken to determine the distribution of BISV in commercial blueberry fields across the Lower Mainland.

METHODS: In July and August 2000, 141 blueberry plants were sampled from 25 farms where growers or consultants reported suspicious symptoms. New leaf growth from branches exhibiting symptoms was used for testing, although some symptomless plants were also sampled. Two neighbouring fields were sampled more intensively in order to determine the field distribution. DAS-ELISA (Agdia Inc.) was used to detect BISV. Samples were also tested for blueberry shock virus, which has not been detected in BC.

RESULTS AND COMMENTS: BISV was detected in many different cultivars and ages of plants (Table 1), and it was present in most regions sampled across the Lower Mainland (Figure 1). BISV was detected in both symptomatic and symptomless plants selected in two neighbouring fields (Figure 2), demonstrating that a lack of symptoms should not be used as an indicator for the absence of BISV. Occasional symptom expression in cultivars reported to be symptomless in Washington State raises the possibility that the BISV strain in BC is different from the BISV in Washington State. Investigation is underway to determine if BC has the New Jersey (Sheep Pen Hill) strain, the Washington strain, or both strains.

The widespread distribution of BISV was alarming. Research is urgently needed to understand the disease and its potential impact on BC blueberry production. All samples were negative for blueberry shock virus.

Table 1. Cultivar and age of blueberry plant samples testing positive for Blueberry Scorch Virus in British Columbia's Lower Mainland.

LOCATION	CULTIVAR	APPROXIMATE PLANT AGE (years)
Abbotsford	Berkeley	>15
	Bluecrop	>15
	unknown	3
	unknown	>15
Surrey	June	>15
	Weymouth	>15
	Duke	unknown
	unknown	5
	unknown	5
	unknown	>15
	Toro	5
	Duke	2
	Bluecrop	4
Delta	Duke	unknown
Matsqui	Duke	4
	Bluecrop	>15
	Bluejay	>15
Pitt Meadows	Dixi	>15
	June	>15
	unknown	8
	Bluecrop	>15
	unknown	>15
Port Coquitlam	Dixi	>15
Richmond	Bluecrop	>15
	Weymouth	>15
	unknown	>15
	June	>15
	Rancocas	>15

Figure 1. Regions sampled for Blueberry Scorch Virus in Lower Mainland of British Columbia in 2000. Numbers in parentheses indicate number of fields testing positive / total number of fields sampled.

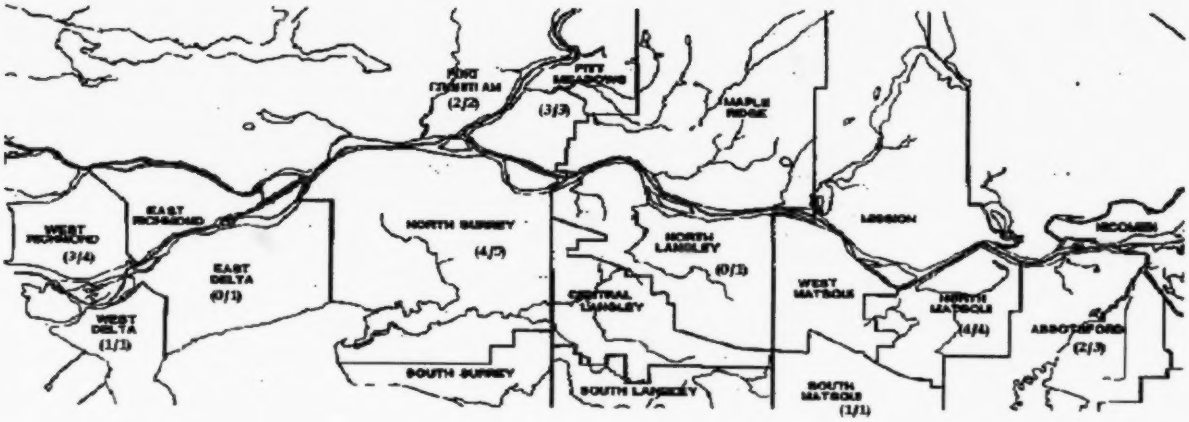
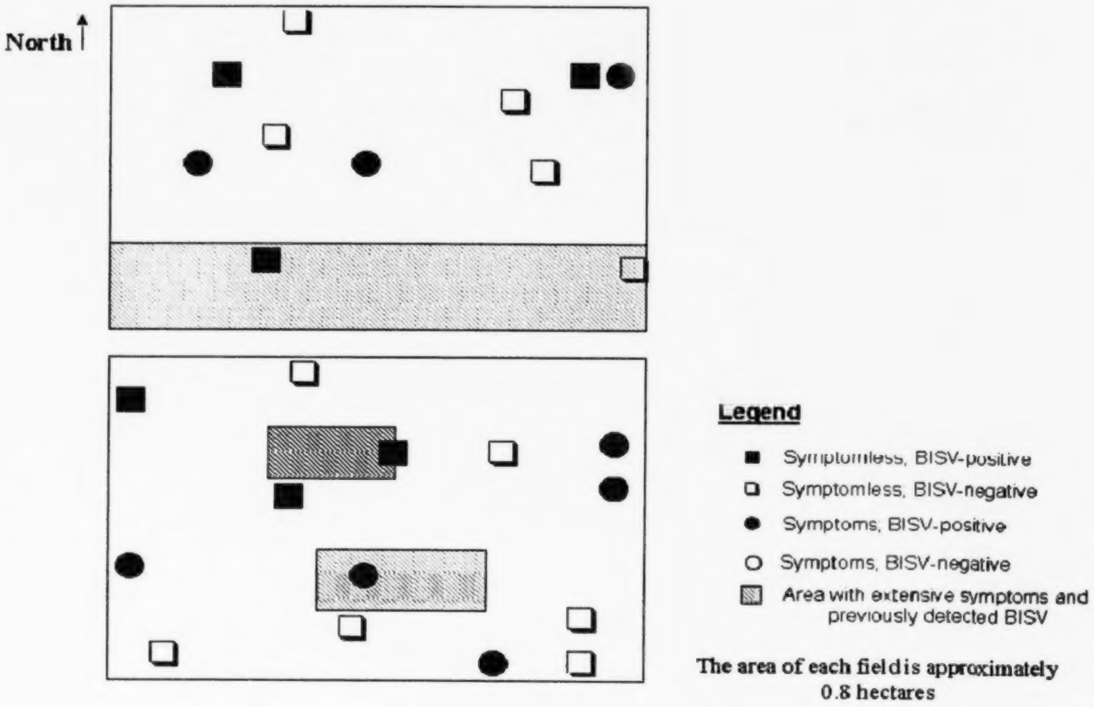

PORT COQUITLAM
(2/2)
PITT MEADOWS
(3/3)
MAPLE RIDGE
WEST RICHMOND
(3/4)
EAST RICHMOND
NORTH SURREY
(4/5)
NORTH LANGLEY
(0/1)
MISSION
NICOMEN
EAST DELTA
(0/1)
WEST DELTA
(1/1)
CENTRAL LANGLEY
WEST MATSQUI
NORTH MATSQUI
(4/4)
ABBOTSFORD
(2/3)
SOUTH SURREY
SOUTH LANGLEY
SOUTH MATSQUI
(1/1)

Figure 2. Distribution of Blueberry Scorch Virus in 2 adjacent fields in Lower Mainland of BC.


North
Legend
■ Symptomless, BISV-positive
❑ Symptomless, BISV-negative
● Symptoms, BISV-positive
○ Symptoms, BISV-negative
▨ Area with extensive symptoms and previously detected BISV

The area of each field is approximately 0.8 hectares

CROP: Grape (*Vitis vinifera*)

LOCATION: Niagara Peninsula, Ontario

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TITLE: SURVEY FOR FLAG LEAF SYMPTOMS OF POWDERY MILDEW IN GRAPE IN NIAGARA PENINSULA, ONTARIO, 1991-1994

INTRODUCTION AND METHODS: *Uncinula necator*, causal agent of powdery mildew of grapevine, has been reported to overwinter as dormant mycelium in buds and as cleistothecia lodged in trunk bark. Knowledge of the source of primary inoculum is important for making decisions regarding chemical control early in the growing season. Infections surviving in dormant shoots are expressed as "flag shoots" as early as bud break in most grape growing areas in the world. Sporulation can occur on these flag shoots almost immediately, providing a source of primary inoculum very early in the growing season. Ascosporic infections arising from inoculum overwintering in cleistothecia require specific environmental conditions for release of ascospores (0.25 mm rain and minimum of 10°C). A survey for flag shoots was conducted when shoots were 15-25 cm in length (mid-June) in commercial vineyards in the Niagara Peninsula, 1991-1994. All or some of the following cultivars were present at each site and were sampled separately: Riesling, Chardonnay, S.V. 23-512, Gewurztraminer, Cabernet Sauvignon, Cabernet Franc. A total of 22, 24 23 and 21 sites were included in 1991, 1992, 1993 and 1994, respectively. At each site for each cultivar, all shoots on each of 100 randomly selected vines were examined for the presence of flag shoots.

RESULTS AND COMMENTS: No flag shoots were recorded at any of the sites in any cultivar over the 4-year period of the survey implying that flag shoots are not the source of primary inoculum for *U. necator* in the Niagara region. Similar findings have been reported in New York. (1)

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CROP / CULTURE: Peach, Nectarine, Apricot, Plum

LOCATION / EMPLACEMENT: Ontario, British Columbia, Quebec, Nova Scotia

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TITLE / TITRE: **OUTBREAK INVESTIGATION AND DETECTION SURVEY FOR PLUM POX POTYVIRUS IN 2000**

INTRODUCTION: Plum pox is the most serious disease of plum, apricot and peach in Europe. It is caused by the plum pox virus (PPV). Different strains of the virus occur with variable host susceptibility and symptoms. Fruit quality, size and quantity are affected, often requiring removal of infected trees. Yield and overall economic losses have been catastrophic to plum and peach growers in many countries. On heavily infected trees, fruit can drop 20-30 days before the normal maturity date and fruit that remains on the tree may lack flavour and be low in sugar content. The main source of PPV is infected trees or budwood. The virus is spread locally by several species of aphids.

First identified in Bulgaria, plum pox is now reported in most European countries, in parts of Asia and northern Africa, and in South America (Chile). In October 1999, the D-strain of PPV was discovered on peaches grown in Adams County, Pennsylvania. This was the first report of PPV in North America and prompted the CFIA to initiate surveys in Canada in 2000, which are reported here.

METHODS: Initially, the survey targeted orchards which had been planted with material imported from Pennsylvania in the past 3-4 years. This material (all peach or nectarine) was distributed among seven growers, one of whom was in Nova Scotia with the remainder in the Niagara region. In blocks where the Pennsylvania material could be identified, all trees were sampled individually at 12 leaves per tree and each tree considered a separate sample. For a few blocks, the trees imported from Pennsylvania were inter-planted with existing trees and could not be specifically identified. In such cases, the blocks were composite sampled according to a systematic random sampling protocol. The starting point for sampling a block was chosen by randomly selecting the start tree from among the first four trees in one corner of the block. Each composite sample contained 12 leaves collected from a group of four consecutive trees in a row (3 leaves per tree). Twelve trees were then counted and skipped followed by the collection of another composite sample from the subsequent four trees. This pattern was continued throughout the entire block so that 25% of the trees were included in composite samples. The composite sampling protocol was the principal survey method used for the national detection survey which was implemented after the discovery of the first PPV positive.

A triple antibody sandwich (TAS-ELISA) was used as the main diagnostic method in the survey (monoclonal antibody: 5B-IVIA, Durvis s.I, Spain). Details of the methodology are described in the CFIA Centre for Plant Health test protocol TF0001-01. Samples were tested at three CFIA laboratories (Sidney, B.C., Charlottetown, P.E.I. and Nepean, Ontario). Sample preparation support was provided by laboratories of Agriculture and Agri-Food Canada in Summerland, British Columbia and Vineland, Ontario.

RESULTS AND COMMENTS: On June 23, 2000, the CFIA confirmed the presence of PPV in the town of Niagara-on-the-Lake, Ontario. PPV was discovered in three 'Fantasia' nectarine trees in two commercial orchard blocks owned by two different growers, located about 3 km apart. Laboratory testing by the CFIA's Centre for Plant Health in Sidney, B.C. confirmed the virus was PPV strain-D.

A large-scale survey was implemented that included all the main stone fruit production areas in Canada. Cherries were excluded from the survey because they are not susceptible to the common strains of PPV. Table 1 summarizes the numbers of samples collected in each of the provinces involved. The majority of the samples were collected as part of a national PPV detection survey or from delimitation surveys around positive blocks using the composite method described above. In total, 70-100% of the commercial stone fruit production in Ontario was sampled in most of the production districts. In Quebec and Nova Scotia all commercial stone fruit orchards were sampled and in British Columbia about 30% of the production was randomly selected for inclusion in the survey. The figures in Table 1 also include a small number of individual-tree samples collected from all mother blocks across Canada, as well as a survey of 15% of the saleable PPV-susceptible nursery stock (fruit tree and ornamentals) within the Niagara region.

Table 1. PPV-susceptible *Prunus* samples collected in Canada in 2000.

PROVINCE	# SAMPLES[1]	# POSITIVE SITE LOCATIONS	# POSITIVE SAMPLES
Ontario	100914	572	947
British Columbia	9043	0	0
Nova Scotia	1377	1	43
Quebec	784	0	0

[1] Figures include individual-tree sampling, composite samples, as well as a small number of samples collected for strain typing and *ad hoc* inquiries.

[2] 53 in the Niagara Peninsula, 2 near Blenheim, 1 near Simcoe, and 1 near Fonthill (all sites were comprised of blocks in commercial fruit orchards with the exception of one sample taken from a block of fruit tree nursery stock planted within a commercial orchard)

[3] In the initial survey in Nova Scotia, a single positive composite was detected. The block containing the positive was re-sampled on an individual tree basis (each tree being a separate sample) and three additional trees tested positive.

CROP: Sweet Cherry (*Prunus avium*)

LOCATION: British Columbia

NAME AND AGENCY:

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TITLE: **LITTLE CHERRY VIRUS SURVEY IN THE OKANAGAN AND KOOTENAY VALLEYS OF BRITISH COLUMBIA**

METHODS: Cherry trees in the Okanagan and Kootenay Valleys of British Columbia were surveyed between 26 June and 23 August 2000 for little cherry disease virus (LCV). Orchards in districts with a history of the disease as well as other orchards with no known history were examined. Areas surveyed included Creston, Kelowna, Keremeos/Cawston, Naramata, Peachland, Oliver, Penticton, Summerland, Westbank, Winfield/Oyama and Vernon. Diagnosis of little cherry disease was based on a positive reaction in an ELISA test using antibody to the little cherry virus coat protein (Theilmann *et al.*, unpublished).

RESULTS AND COMMENTS: A total of 935 cherry trees were tested from orchards and residential properties. One-hundred and two trees tested positive for little cherry virus (10.9%), with 17 positives in Creston (12.2% of samples collected in Creston) and 85 positives in Penticton (16% of samples collected in Penticton). All Okanagan positives were in the Penticton area. One orchard in Penticton with a long history (30+ years) of LCV was intensively surveyed. Each tree was sampled individually. Of the 349 trees tested, 38 were positive (10.9%). Positive samples showed a clustered pattern, indicating a slow rate of spread.

REFERENCE:

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Forest trees/ Arbres forestiers

CROP / CULTURE: Balsam Fir

LOCATION / REGION: Québec

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TITLE/TITRE: PATHOGENIC FUNGAL SPECIES ON BALSAM FIR IN SOUTHERN QUEBEC

METHODS: The incidence of *Abies balsamea* (L.) Mill. (Balsam Fir) diseases was assessed in four groups of three trees with symptomatic branches (branch and needle necrosis and needle cast) in the Sherbrooke region, Québec, in 1999. Two small branches (30 cm long) were collected randomly from each tree group and used for disease assessment, pathogen isolation on agar media (potato dextrose agar and malt agar) and fungus species identification. Diseases were grouped by their isolation frequency, on the following scale : +, occasionally present (1-10%), ++ frequent (10-25%) and +++, very frequent (>25%).

RESULTS AND COMMENTS: Results are presented in Table 1. Of 13 identified fungal species, seven (54%) have not been reported previously on *A. balsamea* in Quebec (SPPQ/QSPP, 1996). The needle pathogens *Cytospora friesii*, *Phaeocryptopus nudus* and *Phyllosticta* sp. had the largest incidence (>25%). Furthermore, *Fusicoccum abietinum* dominated (10-25%) on buds and twigs and the rust pathogen *Melampsorella caryophyllacearum* was frequently found (10-25%) causing systemic brooms. Other fungal species were occasionally present, including *Leptomelanconium abietis* on chlorotic needles recently described by Vujanovic and St-Arnaud (2001).

REFERENCES:

Société de Protection des plantes du Québec/Quebec Society for the Protection of Plants (SPPQ/QSPP) 1996. Names of plant diseases in Canada. Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ), Québec. 476 pp.

Vujanovic, V. & St-Arnaud, M. 2001. *Leptomelanconium abietis* sp. nov. on *Abies balsamea*. Mycologia 93: 211-214.

Table 1. Incidence of pathogenic and other microfungi on needles and branches of *Abies balsamea* (L.) Mill. (Balsam fir) in southern Quebec in 1999.

FUNGAL SPECIES	PART OF TREE	DISEASE OR SYMPTOM	ISOLATION FREQUENCY[2]	PLOT NO.[3]	NEW RECORD (fungus/host relation)
Acrophragmis sp.	Needle	-	+	2	Yes
Cytospora friesii (Dubai) Fuckel	Needle and Twig	Cytospora canker	+++	1	No
Foveostroma abietinum (Peck) DiCosmo	Twig	Foveostroma Canker	+	4	Yes
Fusicoccum abietinum (Hart.) Prill. & Delacr.	Bud and Twig	Bud and shoot dieback	++	3	Yes
Hymenoscyphus sp.	Needle	-	+	1	Yes
Leptomelanconium abietis[1] Vujanovic & St-Arnaud	Needle	Needle cast	+	1	Yes
Melampsorella caryophyllacearum Schröter	Branches	Yellow witches'-broom	++	4	No
Phaeocryptopus nudus (Peck.) Petr.	Needle	Needle cast	+++	1	No
Phoma sp.	Needle and shoot	Black shoot	+	2	Yes
Phyllosticta sp. (*Tiarosperella* sp?)	Needle	Needle cast	+++	1	Yes
Scoleconectria cucurbitula (Tode :Fr.) C. Booth	Branches	Scoleconectria dieback	+	4	No
Sclerophoma pythiophila (Corda) HöhnelSclerophoma pythiophila (Corda) Höhnel	Needle and Twig	Sclerophoma dieback	+	3	No
Delphinella balsameae (Waterman) E. Muller	Bud, Needle and Twig	Tip blight	+	1	No

[1] Recently described fungal species (Vujanovic & St-Arnaud 2001).

[2] Isolation frequency scale : +, occasionally present (1-10%), ++ frequent (10-25%) and +++, very frequent (>25%)

[3] Four sampling plots (one group of three trees per plot - 16 m^2) were chosen, within square distance of 20 m; Single locality at Frontenac Park, on the south shore of Lake Saint-François (Sherbrooke, Québec)

CROP / CULTURE: Butternut

LOCATION / REGION: Eastern Canada

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TITLE / TITRE: DISTRIBUTION OF BUTTERNUT CANKER *(SIROCOCCUS CLAVIGIGNENTI-JUGLANDACEARUM)* IN EASTERN CANADA

INTRODUCTION: Butternut *(Juglans cinerea* L.) in Canada and the United States is endangered by butternut canker disease. Infection by the fungus *Sirococcus clavigignenti-juglandacearum* N.B. Nair, Kostichka & Kuntz, causes branch and stem cankers that can result in severe damage to the tree and often whole tree mortality. It is not known how long this disease has existed in North America, however it isbelieved to have been introduced (Furnier et al 1999). It was first reported from Wisconsin in 1967, but the causal agent was not described until 1979. In Canada, butternut canker was first collected in Quebec in 1990 (Innes and Rainville 1996), and then in Ontario in 1991 (Davis et al 1992), and in New Brunswick in 1997 (Harrison et al. 1998). It is known from the aging of cankers that the disease has been present in Ontario for at least 20 years. In 1990, the US Forest Service listed butternut as a sensitive species in the United States, and in most states where butternut occurs it is listed as a species of concern, largely due to this canker disease. The following reports on the distribution of this disease across eastern Canada.

METHODS: Data were collected from routine surveys of hardwoods by the Canadian Forest Service in Ontario and New Brunswick, and the Ministry of Natural Resources in Quebec. Butternut is not a very abundant tree species but occurs in small clumps or as single trees in association with other hardwoods. Because of this low density of potential host trees standard survey methodology utilizing transects could not be applied. Field technicians sought out known areas of butternut and conducted, in many instances, single tree evaluations. Locations where dead or dying trees were detected were sampled and routine isolation procedures were used to confirm the presence of *S. clavigignenti-juglandacearum*. Data were compiled from the various jurisdictions and mapped using a geographic information system.

RESULTS AND DISCUSSION: The natural range of butternut extends throughout the northern eastern United States and the southern portion of eastern Canada. In Canada this tree species is found as scattered trees, or in small groups among other hardwoods in the deciduous forest region, the southeastern portion of the Great Lakes-St. Lawrence forest region and the western section of the Acadian forest region, from Ontario to New Brunswick (Figure 1). Ecologically, butternut is an important source of wildlife mast, especially in the northern part of its range where walnut is not present.

Butternut canker is currently known to exist throughout the range of butternut in Ontario and Quebec, with limited distribution in New Brunswick (Figure 1). The most obvious symptoms of the disease are elongated, sunken cankers on the bark (Figure 2). These cankers are frequently associated with wounds, but also with leaf and bud scars. During the spring and early summer, an inky-black fluid exudes from cracks in the canker. In the summer, the cankers appear as sooty black patches, often with whitish margins. The cambium layer beneath and surrounding the canker is dark-brown to black in color and dead. Cankers are perennial, and bordered by successive layers of callus tissue. Infection often originates in the lower crown and spreads downward as spores from the cankers are washed by rain along the branches and main stem.

Other members of the walnut family (Juglandaceae) also show some susceptibility to the pathogen when inoculated artificially. In Quebec, seedlings of black walnut *(Juglans nigra* L.) infected with the disease have been reported from tree nurseries. However, damage to black walnut is limited to small branch cankers, and severe infections on black walnut in forests or plantations have not been observed to date. Nevertheless, studies in Quebec have shown that the fungus is associated with the fruits of black walnut and butternut and the disease can be transported to new sites on the fruit (Innes 1998).

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Innes, L. 1998. *Sirococcus clavigignenti-juglandacerum* on butternut and black walnut fruit. Pages 129-132 *in* Foliage, shoot and stem diseases. Proceedings of the IUFRO WP 7.02.02 meeting, Quebec City, May 25-31, 1997. G. Laflamme, J.A. Bérubé, R.C. Hamelin, editors. Info.Rep. No. LAU-X-122, Nat Res. Can., Canadian –Forest Service, Sainte-Foy, Quebec.

Innes, L. and Rainville, A. 1996. Distribution et détection du *Sirococcus clavigignenti-juglandacearum* au Québec. Phytoprotection 77: 75-78.

Figure 1. The range of butternut, and known locations of butternut canker in Canada.

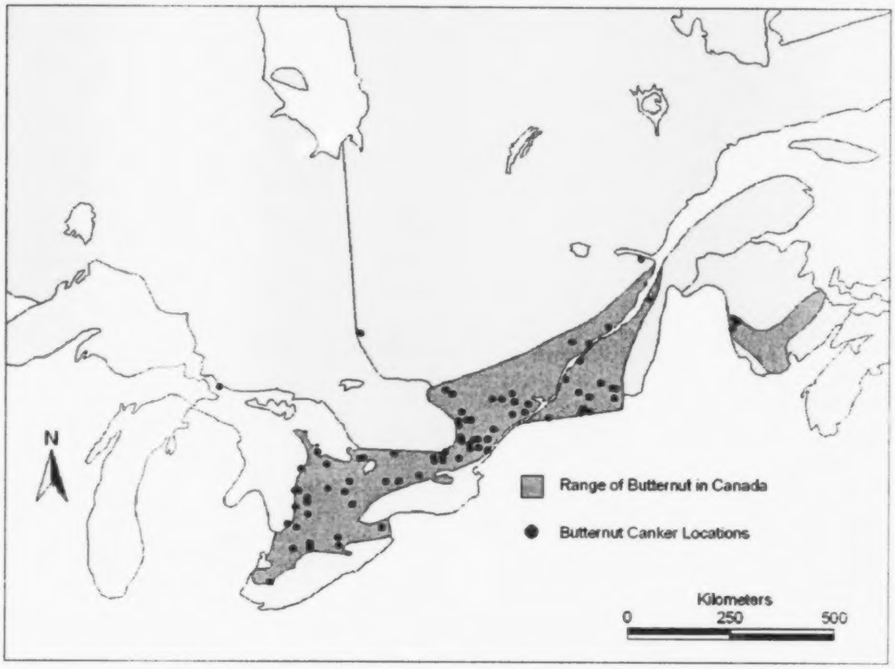
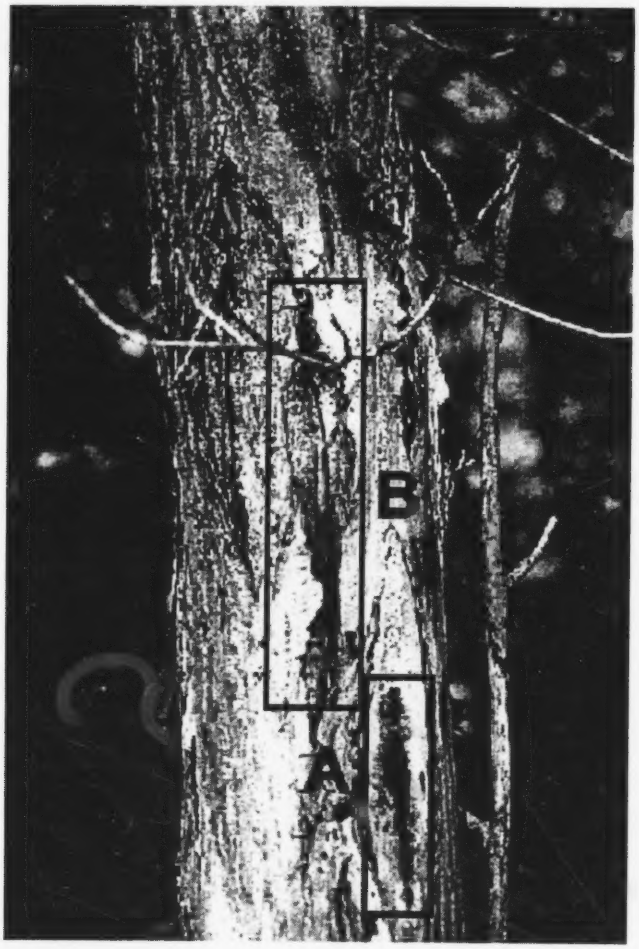

N
▨ Range of Butternut in Canada
● Butternut Canker Locations
Kilometers
0
250
500

Figure 2. Active butternut cankers show a symptomatic black exudate **(A)** and older cankers **(B)**, which the tree has attempted to heal-over, are indicated by seams in the bark.



CROP / CULTURE: Chêne rouge (Red oak, *Quercus rubra*)

LOCATION / REGION: Québec

NAME AND AGENCY / NOM ET ORGANISME:

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TITLE / TITRE : LE CHANCRE FUSARIEN SUR LE CHÊNE ROUGE (*QUERCUS RUBRA*) AU QUEBEC EN 1999 ET 2000

INTRODUCTION ET METHODES: On retrouve, dans le sud du Québec, plusieurs anciennes terres agricoles abandonnées. Le reboisement de ces terres se fait fréquemment par la plantation de *Quercus rubra* L. et *Q. macrocarpa* Michx. après préparation du terrain (Cogliastro et al. 1997). Nous avons récemment signalé dans la revue Plant Disease, l'apparition du *Fusarium solani* dans une plantation de chêne rouge de Cazaville (Vujanovic *et al.*, 1999). *Fusarium solani* cause des chancres annuels sur le tronc et les branches ainsi que le dépérissement d'une partie de la couronne. C'est la première mention de l'apparition des symptômes dus au fusariose sur les chênes rouges au Québec et au Canada. Auparavant, *Fusarium* n'a été signalé que sur les chênes rouges et noirs de la section LOBATAE: *Q. nuttallii* E.J. Palm. , *Q. rubra* L., *Q. phellos* L., *Q. nigra* L. de la côte est américaine (Sinclair 1993). Son apparition y a eu un impact négatif sur la production commerciale du chêne (Dochinger 1967). En Europe, le champignon isolé à partir des chênes atteints avait un très haut niveau de pathogénécité et de phyto-toxicité *in vitro* sur les semis de chênes (Ragazzi 1993).

Afin d'établir et d'estimer le rôle de la diversité des pathogènes dans la symptomatologie du chancre et du dépérissement du feuillage, quatre méthodes ont été appliquées:
Deux méthodes pour le chancre: i) Isolation des souches des parties du chancre sur les milieux d'agar (potato dextrose agar, malt agar) et ii) stimulation de l'exposition des souches, dans une chambre humide, (formation de sporodochie dans le cas de *Fusarium*);
Deux méthodes pour le dépérissement du feuillage: *i)* trempage du bois attaqué au niveau du système vasculaire (nécrose) dans l'eau en barbotage avec la présence de bouture stérile de chêne rouge et *ii)* passage du mycélium du pathogène vers des pièces de bois stériles insérées à l'intérieur de parties de bois symptomatique.

RESULTATS ET COMMENTAIRES : La maladie a été observée chez les arbres âgés de onze ans (semis 2+0 plantés en 1989). Deux modes d'action de *Fusarium* (pathogénicité et toxicité) se caractérisent avec des symptômes de chancre sur les tiges et les branches et de flétrissement des feuilles et des rameaux. On y a observé des symptômes chez plus de 50% des arbres, dont 25% des individus avaient des dommages jusqu'à 3m de hauteur de fût en 1999 et 27% en 2000. En 2000, le taux d'infection a été plus élevé (34%) dans des parcelles qui ont subi des traitements (paillis de plastique ou herbicide glyphosate) en comparaison avec le témoin (Table 1.). La maladie pourrait s'étendre et menacer la production commerciale du chêne. Parmi les autres pathogènes qui causent les chancres et les symptômes d'anthracnose, nous avons isolé occasionnellement (1% des échantillons) les espèces microfongiques (micromycètes) : *Apiognomonia*, *Botryosphaeria*, *Phomopsis* et *Valsa*.

À cause des connaissances incomplètes concernant les formes et les variétés de *Fusarium solani*, espèce complexe (O'Donnell, 2000), et en tenant compte de la diversité de la microflore parasite impliqué, il semble difficile de diagnostiquer et de pronostiquer le développement de la pathologie du chêne rouge dans les régions écologiques du Québec et du Canada. L'apparition d'un tel problème phytosanitaire en plantation de feuillus souligne l'importance de définir et d'adopter des mesures de précaution.

Nous proposons des travaux de recherche qui permettraient de mieux caractériser le champignon. Ces connaissances seraient à la base d'un futur programme visant à circonscrire l'aire de répartition du parasite et à examiner la résistance de différentes provenances québécoises et canadiennes de chêne rouge. Il est proposé de caractériser la virulence, la toxicité et le profil génétique de *Fusarium solani*, en cinq étapes:
Plusieurs isolats pour représenter la diversité de la population : isoler des souches des plantes symptomatiques et asymptomatiques et sélectionner les isolats sur la base de critères morphologiques et culturaux; une souche américaine serait également incluse aux tests de virulence et de toxicité;

Virulence et toxicité des isolats: étudier la virulence et la toxicité des souches isolées, afin de déterminer la ou les souches responsables des symptômes de chancre et d'anthracnose *in situ*;

Profil génétique des isolats: analyser le profil génétique des souches isolées afin de préciser l'identification des isolats et de permettre la reconnaissance ultérieure à l'aide de sondes moléculaires spécifiques;

Comparaison: notre souche avec d'autres au Canada et avec souches des États-Unis; et

Croisement des connaissances: virulence-toxicité-génétique.

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Vujanovic, V., A.Cogliastro, M. St-Arnaud, P. Neuman, and D. Gagnon, 1999. First report of *Fusarium solani* canker and wilt symptoms on red oak (*Quercus rubra*) in Québec, Canada. Plant Dis. 83:78.

Table 1. Présence de fusariose sur le troncs (*Quercus rubra*) à moins de 3 mètres du sol selon le traitement en 2000, Québec.

TRAITMENT	**TÉMOIN**	**PAILLIS**	**HERBICIDE**	**TOTAL**
Arbres infectés	16	36	34	86
Total	81	123	116	320
Infection (%)	198	293	293	269

CROP: Larch

LOCATION: New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland

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TITLE: STATUS OF EUROPEAN LARCH CANKER IN ATLANTIC CANADA 2000

METHODS: Field surveys for European larch canker (*Lachnellula willkommii*) were conducted in selected forest stands and plantations with a native or exotic larch (*Larix* spp.) component at the appropriate time for symptom expression. European larch canker (ELC) is under quarantine regulation in the Maritime Provinces. ELC surveys were conducted in New Brunswick (NB), Nova Scotia (NS), Prince Edward Island (PEI), Newfoundland (NF) and Labrador. In 2000, surveys were concentrated along the boundary of the known distribution and in areas outside of the quarantine regulated areas, which comprise the southern half of NB (approximately), mainland NS and part of Prince County, PEI. An extensive survey was conducted to ensure that ELC does not occur in either Newfoundland or Labrador.

RESULTS AND COMMENTS: In Canada, European larch canker is found only in the Maritime Provinces with a known distribution that includes portions of NB, NS and PEI. A map of the plant quarantine regulated area for European larch canker is available online at the Canadian Food Inspection Agency (CFIA) website (http://www.cfia-acia.agr.ca/english/ppc/science/pps/1999maps/lwcan99.jpg). The results of earlier surveys in Atlantic Canada have been reported previously (Hurley et al, 2000).

In 2000, a total of 151 locations were surveyed in the Atlantic Provinces. Locations surveyed in NB, NS and PEI numbered 15, 45 and 32, respectively. All were negative, except for one new location just outside the previously known distribution in central NB (Figure 1). This is just inside the regulated area as defined by the CFIA.

In Newfoundland and Labrador, 59 locations were surveyed for ELC. Forty six locations were surveyed on the Island of Newfoundland and 13 in eastern Labrador. No ELC was found in Newfoundland or Labrador during this survey. An ELC distribution map for the Maritime Provinces is included as Figure 1.

ACKNOWLEDGEMENTS: The authors gratefully acknowledge the technical field assistance of Art Doane, Dave O'Brien and Tom Walsh.

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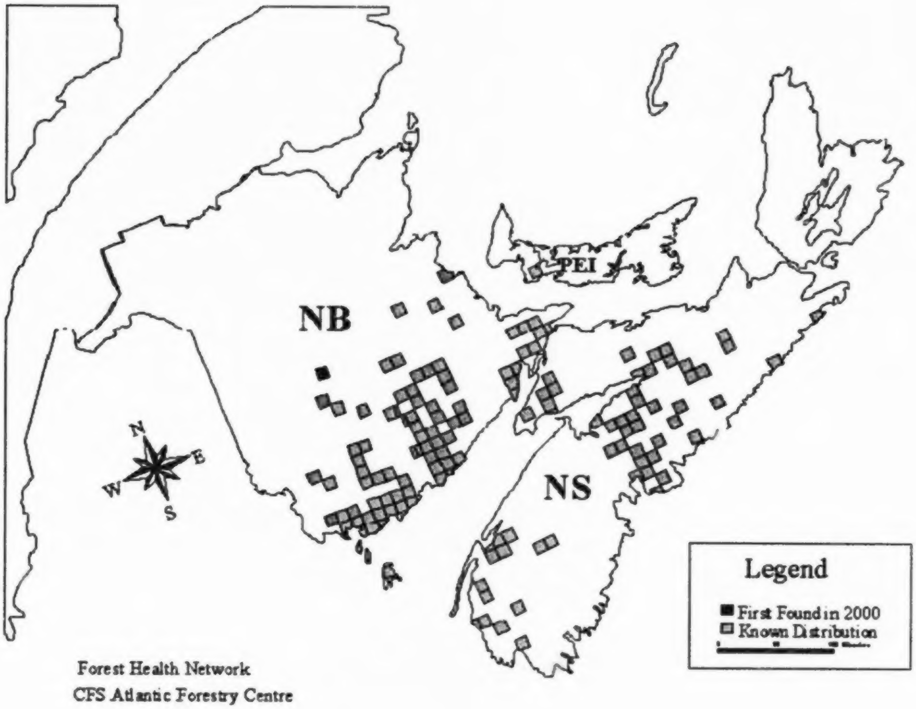
NB
PEI
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N
E
S
W
Legend
■ First Found in 2000
▨ Known Distribution
Forest Health Network
CFS Atlantic Forestry Centre

Figure 1. Distribution of European larch canker in Atlantic Canada - 2000.

CROP: Lodgepole pine

LOCATION: British Columbia, Northern Interior-Coastal Transition Forests

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TITLE: FOLIAR DISEASE ASSESSMENT IN YOUNG (1-20 YEAR OLD) LODGEPOLE PINE STANDS IN NORTH-WESTERN BRITISH COLUMBIA

METHODS: Dothistroma needle cast caused by *Mycosphaerella pini*, a foliar disease of lodgepole pine (*Pinus contorta*), has become prevalent throughout the north-west interior of BC in the past few years. This survey focused on determining the incidence and severity of this foliar disease throughout juvenile lodgepole pine stands of the Kispiox Timber Harvesting Landbase (THLB) (Figure 1).

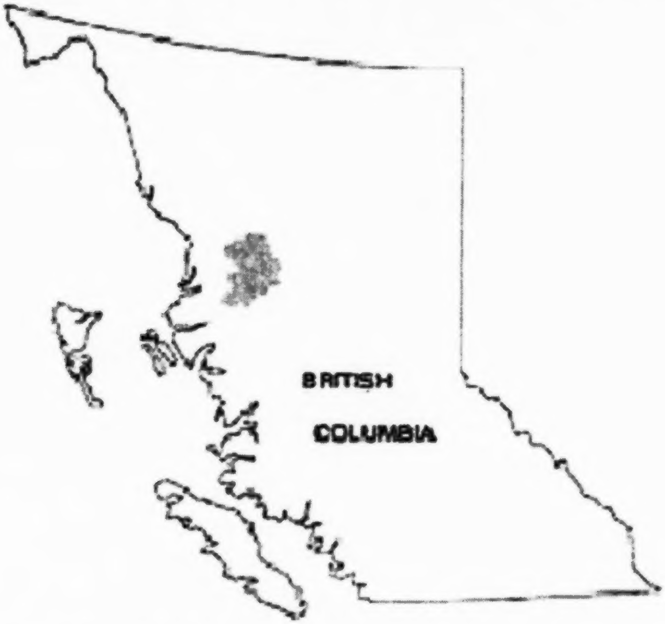

Figure 1. Location of the Kispiox Timber Supply Area, an administrative boundary that encompasses the THLB study area.

The Timber Harvesting Landbase is the area of Crown forest land that is accessible to logging activities. The total area of lodgepole pine leading stands in the Kispiox THLB is approximately 11,000 ha. A list of all stands aged 1-20 years with > 50% of their stocking comprised of lodgepole pine was compiled from the BC Ministry of Forests database. A random number was assigned to each of these candidate stands. The random numbers were then sorted and the first 100 stands were selected for surveys. The total area of surveyed stands was 1,196 ha or approximately 10% of the total population of pine leading stands.

Each selected stand was then surveyed with 2-m wide, 100 -m long transects up to a survey intensity of 0.5 % of the gross plantation area. The location of the transects was established on 1:10,000 scale maps prior to the field survey. All trees > 1.5m height within the transect were assessed for dothistroma needle cast. The year of first attack and an estimate of the percentage of the crown affected was made for all trees infected with foliar disease. The incidence and severity of foliar disease was determined for each plantation (e.g. 10% of lodgepole pine trees are more than 50% defoliated due to dothistroma foliar disease).

RESULTS AND COMMENTS: Dothistroma needle cast was present in 76% of stands in the study area. The growing season of 1998 was the first in which the majority of the lodgepole pine trees in the Kispiox were infected. Trees with the greatest amount of foliar disease-induced needle loss, however, had their first infections in the 1997 growing season or earlier. The severity of foliar disease depends on both the incidence of diseased trees and the degree of infestation on those trees. Trees with less than 20% of their foliage affected likely do not suffer measurable growth losses. Trees with more than 20% probably begin to suffer some growth losses. It is clear from some of the stands that were included in this survey and others I have seen, that once a tree has more than 80% of its foliage affected, significant growth losses occur.

There was a considerable range in foliar disease severity throughout lodgepole pine stands in the Kispiox. The percentage of live crown affected by foliar disease ranged from < 5 % to > 85 %. The percentage of trees affected in any one stand ranged from 0 to 100%. I have reported the severity of foliar disease based on the percentage of stands that have foliar disease incidence from < 25% to > 75% of their trees suffering from < 20% to > 80% defoliation (Figure 2).

The majority of infested stands have less than 25% of the trees infected (Figure 2). The most serious concerns are those stands that have greater than 50% of the trees more than 50% defoliated. Only 2% of the stands have a foliar disease severity of that magnitude. The disease outbreak does not appear to be subsiding yet so it is quite possible that more of the stands will suffer greater foliage losses.

It is not clear what has led to the current outbreak of foliar disease in the study area. It is likely that the unusually mild winters and wet summers of the past three to five years have contributed, as the spores of the pathogen are spread by rain splash (Peterson, G. 1981). The mild winters have likely resulted in less of the infected needles being shed during the winter. The spores from the infected needles can then be spread further up into the crowns of affected trees. If the weather of the past 3-5 years is in part responsible and the projections of global warming materialise, then the prognosis for the health of the lodgepole pine plantations in the Kispiox is not good.

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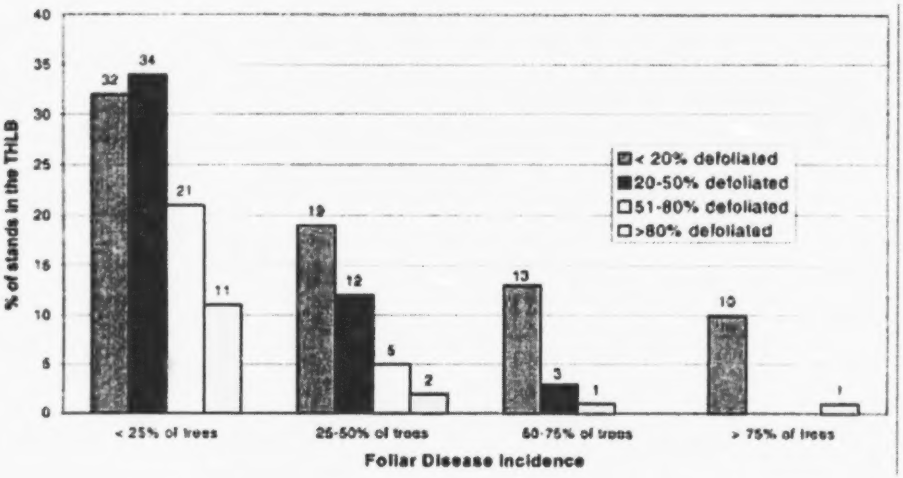
Peterson, G. 1981 Control of Diplodia and Dothistroma blights of pines in the urban environment. J. Arboriculture 7:1-5.

Figure 2. Percentage of juvenile lodgepole pine stands in the Kispiox Timber Harvesting Landbase that are infested with dothistroma needle cast, based on a survey of 100 stands in the 2000 field season.



CROP / CULTURE: Pine species

LOCATION / REGION: Québec

NAME AND AGENCY / NOM ET ORGANISME:

V. Vujanovic and M. St-Arnaud, Institut de recherche en biologie végétale (IRBV), Université de Montréal & Jardin botanique de Montréal, 4101 est, rue Sherbrooke, Montréal, Québec, Canada H1X 2B2 Telephone : (514) 872-0447; Facsimile : (514) 872 9406; e-mail:vujanovv@umontreal.ca

TITLE/TITRE: **PATHOGEN BIODIVERSITY IN PINE TREE COLLECTIONS UNDER URBAN ECOLOGICAL CONDITIONS, QUEBEC**

INTRODUCTION AND METHODS: Pine (*Pinus* L.) species are among the most popular coniferous trees planted in urban and suburban landscapes and collections. In practice, forestry focuses on *ex situ* methods for conservation of the genetic resources of particular trees, utilising botanical garden plantations. The Montreal Botanical Garden (MBG) arboretum contains a collection of about 60 pines (species, varieties and cultivars) from around the world. Fungal attacks on various parts of pine crowns can cause serious damage under favourable ecological conditions. In urban areas, some attacks could be favoured by atmospheric impurities which cause the trees to appear chlorotic and thinner than in the surrounding landscape.

To establish an efficient control strategy for pathogens, a particularly important goal was to assess the phytosanitary condition of pine crown components or ecological niches (Cone = C; Branches = B, Needle = N; Seed = S). From 1996 to 2000, a survey at pathogenic fungi on pine was carried out at the MBG in a collection of 48 pine trees originating from North America, Europe and Asia. Twenty-eight pine taxa (age of trees > 5 yrs) were selected on the basis of chlorotic and necrotic symptoms in the crown. On average, three specimens from each taxon were sampled. Each taxon was located in a separate tree grouping. The distance between the pine groups within the arboretum was approximately 20 m. All samples were insect-free and were selected randomly. Samplings and evaluations were conducted three times per year during the growing period. Diagnoses were accomplished by microscopic examination and culturing fungi onto various artificial media.

RESULTS AND COMMENTS: A total of 27 fungal taxa were isolated from diseased material in specific host/ecological niche combinations. Seven species were found on all the CBNS (Cone-Branch-Needle-Seed) niches and six in CBS. Colonization of the CNS niches was associated with four fungal species, CS and N with three, B with two, and CN and S with one species. The most frequently occurring fungal species were *Sphaeropsis sapinea* isolated from 12 hosts, *Herpotrichia juniperi* and *Choanatiara lunata* from eight, and *Truncatella hartigii* and *Strasseria geniculata* from seven hosts each (Table 1). Future investigations will require more attention to the characterization of different fungal strains in order to establish an adequate sanitary control strategy. Moreover, information on the incidence of pathogenic fungi in arboreta might allow the early recognition of potentially important diseases.

REFERENCES:

1. Vujanovic, V., and St-Arnaud, M. 2000. Pine crown-shapes relationship with microfungal communities: Evaluation for urban landscape management. Proc. 4th Internat. Sympos. on Trees. Montreal, August 24-26, IRBV/Montreal Botanical Garden (in press).

2. Vujanovic, V., St-Arnaud, M., and Neumann, P. 2000. Susceptibility of cones and seeds to fungal infection in a pine (*Pinus* spp.) collection. For. Pathol. 30 (in press).

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6. Vujanovic, V., St-Arnaud, M., Neumann, P. 1997. Biodiversity inventories of fungal taxa associated with three different pine crown ecological niches in the Jardin Botanique de Montréal. Amer. J. Bot. 84: 128.

Table 1. Biodiversity of pine pathogenic fungal species (without *Lophodermium* and *Cyclaneusma*-like species) in relation to host taxa and colonized pine tissues.

FUNGAL SPECIES	COLONIZED *PINUS* HOSTS	Colonized Pine Part	REF. NO.
Alternaria sp.	*P. sylvestris* Fastigiata, *P. nigra*, *P.n.* ssp. *nigra*	C, B, N, S[1]	2
Ceuthospora sp.	*P. albicaulis*, *P. tabulaeformis*, *P. sylvestris*, *P. n.* ssp. *laricio*, *P. leucodermis*	C, N, S	2
Choanatiara lunata DiCosmo & Nag	*P. albicaulis* Eng., *P. resinosa* Ait., *P. tabulaeformis*, *P. densiflora*, *P. nigra* Laricio, *P. n.* Pallasiana, *P. n.* ssp. *Nigra*	N	4
Cytospora pinastri Fr.	*P. albicaulis*	C, B, S	2
Diaporthe sp.	*P. mugo* Galica, *P. contorta*	C, B, S	2
Dothistroma septospora (Dor.) Morelet (*Mycosphaerella pini*)	*P. contorta*, *P. nigra*, *P. sylvestris*	N	unp.[2]
Epicoccum nigrum Link.	*P. sylvestris*, *P. nigra*	C, B, N, S	2
Fusarium sp.	*P. sylvestris* Argentea-Compacta, *P. nigra*, *P. n.* ssp. *nigra*, *P. uncinata*	C, B, N, S	2
Fusicoccum sp.	*P. flexilis* Glen Dwarf, *P. mugo* Galica	C, B, S	2
Herpotrichia juniperi (Duby) Petr.	*P. tabulaeformis*, *P. densiflora*, *P. sylvestris* Argentea-Compacta, *P. s.* Beuvronensis, *P. mugo* Galica, *P. rigida*, *P. contorta*, *P. ponderosa*	C, B, N, S	12
Gremmeniella abietina (Lagerb.) Morelet	*P. nigra*, *P. resinosa*, *P. sylvestris*, *P. koreaensis*	B	unp.
Naemacyclus fimbriatus (Schw.) Di-Cosmo, Peredo & Minter	*P. rigida*	C, N	3
Pestalotia funerea (Desm.) Stey.	*P. korainensis*, *P. mugo* Hesse, *P. m.* var. *pumilio*	C, N, S	2
Phoma sp.	*P. sylvestris*, *P. s.* Watereri	C, B, N, S	2
Phomopsis conorum (Sacc.) Died.	*P. sylvestris*, *P. nigra*, *P. mugo* Galica	C, B, S	12
Pleospora laricina Rehm.	*P. mugo* Hesse	S	2
Pleospora sp.	*P. ponderosa*	C, B, S	2
Sclerophoma pithyophila (Corda) Höhn.	*P. xschwerinii (P. strobus x P. wallichiana)*	C, B, N, S	12
Septoria sp.	*P. ayacahuite*	C, S	2
Sirococcus conigenus Preuss	*P. nigra* ssp. *laricio*, *P. ponderosa*	C, N, S	12
Sphaeropsis sapinea (Fr.) Dyko & Sutton	*P. albicaulis*, *P resinosa*, *P. sylvestris*, *P. s.* Euro-Asia, *P. nigra*, *P. nigra* ssp. *laricio*, *P.n.* ssp. *nigra*, *P. leucodermis*, *P. mugo*, *P. m.* Hesse, *P. m.* var. *pumilio*, *P. uncinata*	C, B, N, S	126
Strasseria geniculata (Berk. & Br.) Höhn	*P. albicaulis*, *P. cembra*, *P. jerffreyi*, *P. mugo* Hesse, *P. rigida*, *P. strobus* Torulosa, *P. tabulaeformis*	N	5
Therrya fuckelii (Rehm) Kujala	*P. strobus*	B	1
Trichothecium roseum Link.	*P. albicaulis*, *P. mugo* Galica, *P. uncinata*	C, S	2
Truncatella hartigii (Tubeuf) Stey.	*P. tabulaeformis*, *P. densiflora*, *P. sylvestris* Argentea-Compacta, *P. s.* Beuvronensis, *P. s.* Fastigiata, *P. s.* Watereri, *P. contorta*	C, N, S	12
Tubercularia sp.	*P. peuce*, *P. parviflora*, *P. xschwerinii (P. strobus x P. wallichiana)*, *P. ayacahuite*, *P. ponderosa*	C, S	unp.
Valsa pini (Alb. And Schew.) Fr. Rehm.	*P. koraiensis*, *P. flexilis* Glen Dwarf	C, B, S	126

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[1] Cone = C; Branches = B, Needle =N ;Seed =S [2] unp. = unpublished

CROP: Whitebark pine

LOCATION: British Columbia

NAME AND AGENCY:

S. Zeglen
Vancouver Forest Region, British Columbia Ministry of Forests, Nanaimo, British Columbia

TITLE: WHITEBARK PINE AND WHITE PINE BLISTER RUST IN BRITISH COLUMBIA - 1999

INTRODUCTION: Whitebark pine (*Pinus albicaulis*) is found in subalpine forests throughout the province south of 56 N latitude. The future survival of whitebark pine is threatened by its susceptibility to white pine blister rust (WPBR), an exotic disease caused by the fungus *Cronartium ribicola*. This note highlights the annual progress of a province-wide survey of whitebark pine first reported in CPDS last year.

METHODS: High-elevation stands in the Cascade and Coastal Mountain Ranges having a leading or significant component of whitebark pine were identified using the provincial forest inventory database. Once a stand was located, the surveyor visually inspected for WPBR on the first 50 live and dead whitebark pine trees encountered during a strip transect reconnaissance.

RESULTS: Of the 7043 whitebark pine trees examined in 1999, 1219 (17.3%) were dead (Table 1). Mortality on 558 (45.8%) of these dead trees could be directly attributed to WPBR. Due to the difficulty of diagnosing some dead trees, this figure is conservative as dead trees without obvious stem cankers were classified as dead due to other factors. These other factors include mountain pine beetle (*Dendroctonus ponderosae*), abiotic factors, and unknown or unidentified causes.

Of the remaining 5824 live trees, 1857 (31.8%) were alive but infected with blister rust. Of these infected trees, 1190 (64.1%) have stem cankers and will likely die within a few years. The remaining infected trees displayed branch cankers that may develop into stem cankers over time. In addition, many trees suffered defects such as basal sweep, forks, crooks, and damage from feeding by squirrels.

COMMENTS: The survey should be completed over the rest of the province in the next year.

REFERENCE:

Zeglen, S. 2000. Whitebark pine and white pine blister rust in British Columbia. British Columbia Ministry of Forests. Vancouver Forest Region. Interim Report. 14 pp.

Table 1. Summary of 1999 whitebark pine survey results.

Forest District or Provincial Park	No. of trees	TREE STATUS							
		Live, Uninfected		Live, Infected by WPBR[1]		Dead, from WPBR		Dead, Other or Unknown	
		No.	%	No.	%	No.	%	No.	%
Bulkley-Cassiar	992	437	44.1	337	34.0	61	6.1	157	15.8
Cathedral PP	591	514	87.0	68	11.5	6	1.0	3	0.5
Chilcotin	400	306	76.5	72	18.0	16	4.0	6	1.5
Garibaldi PP	338	240	71.0	65	19.2	14	4.2	19	5.6
Manning PP	2022	991	49.0	568	28.1	165	8.2	298	14.7
Merritt	600	266	44.3	180	30.0	94	15.7	60	10.0
Mid-Coast	200	133	66.5	39	19.5	19	9.5	9	4.5
Morice	650	325	50.0	236	36.3	47	7.2	42	6.5
Penticton	100	56	56.0	34	34.0	5	5.0	5	5.0
Squamish	300	136	45.3	86	28.7	52	17.3	26	8.7
Tweedsmuir PP	850	563	66.2	172	20.2	79	9.3	36	4.3
Total	7043	3967	56.3	1857	26.4	558	7.9	661	9.4

[1] WBPR = white pine blister rust.

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